

2006

Report on the Health of Colorado's Forests

Special Issue: Lodgepole Pine Forests

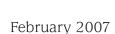












It is with a sense of urgency that we present the 2006 Report on the Health of Colorado's Forests. This is the sixth in a series of reports developed by the Colorado State Forest Service with the guidance of the Colorado Forestry Advisory Board. The 2000 legislation requiring this report proved to be timely since the forests in Colorado have experienced a series of significant ecological events over the past decade, including the dramatic fire season of 2002 and the ongoing bark beetle epidemics.

Each report covers the overall condition of Colorado's forests in addition to a special focus area. The 2006 report looks in depth at lodgepole pine forests and the bark beetle epidemics which continue to grow over hundreds of thousands of acres, killing trees and affecting communities throughout the state. Beetle-killed forests reduce scenic values, impact the economy, increase fire danger, and are therefore a major concern for many Coloradans.

The dead and dying trees do not need to be a story with a sad ending. Rather, the situation can be a call-to-action for residents and lawmakers, providing an opportunity to shape the "next forest." Long-term forest stewardship efforts can increase forest resilience and diversity and help protect our communities and the critical natural resources that Coloradans depend on and enjoy.

Thank you for your interest in Colorado's forests.

Sincerely,

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Table of Contents

Executive Summary
Colorado's Forests: How Did We Get Here? 3
Managing for the Next Forest
Insect and Disease Activity Update 6
Special Section: Lodgepole Pine Forests
Areas of Lodgepole Pine Management
Conclusion
References and Additional Reading
Map of Colorado's Forests foldout after page 24
Map of Colorado Forest Insects and Diseases in 2006
Acknowledgementsinside back cover

Executive Summary

Forests are of great value to all Coloradans and have regional and national importance as well. They provide beautiful views, world-class skiing, forest products, wildlife habitat, and clean, plentiful water. Streams flowing from Colorado's forests contribute to the state's water-dependent economy and that of 18 other states and Mexico.

However, many of Colorado's forests are old, crowded, weakened by drought and very susceptible to forest insects, diseases, and wildfires. Their ability to sustainably produce a full range of public benefits is compromised because they are not as healthy or resilient as they could be. Mountain pine beetle and wildfire are shaping Colorado's forests and, without forest management, will continue to determine how these forests look and function in the future.



Lodgepole pine forests, which grow abundantly in Colorado's mountains, are the focus of this year's report. These high-elevation forests provide the setting where people ski, hike, bike and ride off-road vehicles and horses. Currently, vast expanses of beetle-killed trees are bringing this backdrop to the forefront of people's attention.



Mountain pine beetle populations have exploded into Colorado's most severe outbreak on record. In 2006, more than 650,000 acres (over 1,000 square miles) were infested with mountain pine beetle. The landscapes and high-value resort areas of Grand, Routt, Summit, Eagle and Jackson counties are the most affected. Damage caused by the mountain pine beetle epidemic re-emphasizes the need to proactively manage for diverse and healthy forests.

Most of the mountain pine beetle activity is located at the headwaters of Colorado's drinking water supply, which is also used for irrigation and snowmaking. Many other western states also depend on this water. While intense fires occurred historically in these areas, today they have far-reaching economic and environmental impacts.

Record-breaking temperatures and high-risk forest conditions across the West contributed to the largest wildfire season in the nation since 1960, when wildfire recordkeeping began. In Colorado, over 90,000 acres burned, with many fires occurring earlier than normal.



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Wildfire hazard reduction efforts and clean-up of dead trees from the mountain pine beetle epidemic have cost Colorado landowners millions of dollars.



Wildfire Hazard from Beetle-kill

Fire managers are concerned about the huge swaths of dead trees and the fire hazard because:

- Dead, dry trees catch on fire and burn more easily than wet, green trees.
- Fires become extremely hard to control when there are large accumulations of dead wood on the ground.
- When dead and downed logs burn they can cause soil damage and impact watersheds.
- After the dead trees have fallen and a new forest is growing, there is more fuel than before. This arrangement of surface and standing fuels can feed more destructive wildfires.
- Wildfires would put citizens and firefighters at risk in many high country communities.

The Mato Vega fire burned over 13,000 acres south of the Great Sand Dunes National Monument in June.



Fire ecologists predict that if current warming temperature trends continue, fires throughout the nation will become even more frequent and active. Some contend that these changes have already begun.

Those who own forest land or influence how it is managed have the opportunity today to shape what Colorado's forests will look like tomorrow. Forests can be managed sustainably for a wide variety of public benefits and values. Clean water, recreation opportunities, wood products, habitat for wildlife, and safer communities all add to the quality of life in Colorado. To achieve these goals, the entire landscape, including communities, must be considered.



Colorado's Forests: How Did We Get Here?

Colorado's forests are disturbance driven; they are dependent upon change for maintenance and renewal. Fires, insect and disease outbreaks, and forest management can add diversity and resilience to forest stands or bring about entirely new forests from old ones. However, many of Colorado's old forests have not recently experienced disturbance because of fire suppression and very little tree cutting.

Fire suppression has arguably had a greater impact on Colorado's forests than any other human action.

From 2000-2004, a severe drought occurred that further weakened Colorado's old, crowded forests. The drought was not an anomaly, but a naturally recurring process. Future dry periods will also weaken forests and influence wildfires. While forest managers cannot impact the weather, they can improve forest conditions by reducing competition for sunlight, nutrients and water.

Drought is a recurring natural event that will continue to weaken forests and exacerbate wildfires. It is important that Colorado's forests are as vigorous and resilient as possible to mitigate future landscape-sized insect

outbreaks and wildfires.

Ironically, excluding wildfire from the landscape to protect life and property actually resulted in forest conditions that often make wildfires more dangerous, costly and intense. Trees grow every year, and can become very crowded without fire, tree cutting



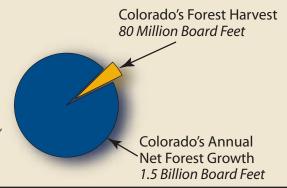
or other disturbance. A forest that is dense with growth can burn hotter and create precarious conditions for people, property, and the environment.

What the next forests look like, and the benefits they produce, will depend on actions that are taken now. Without proactive management, wildfires, insects and other forces will continue to shape Colorado's forests. The resulting landscapes may not meet society's desires and needs and could be even less appealing than those created by the current mountain pine beetle epidemic.

In 2002, fires in Colorado burned over half a million acres and cost over \$152 million to suppress. Many of these fires occurred in the state's old, fire-dependent forests where conditions were worsened by drought.

Forest Growth

The growth of all of the trees in the state is called Colorado's net annual forest growth. About 5% of Colorado's net annual forest growth is harvested each year. This does not include the trees' wood that existed before the annual growth. It is akin to withdrawing interest from a savings account. If only 5% of the annual interest is taken out, the "principal" and the "interest" continue to grow.

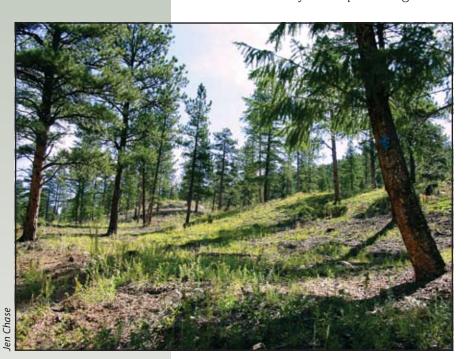


Managing for the Next Forest

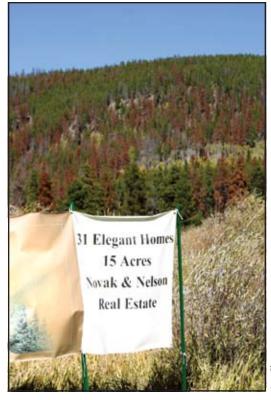
Current forest conditions in Colorado demand that all relevant stakeholders proactively work together to improve forest health and protect communities from wildfire.

About a million people live in six million acres of Colorado's high fire hazard forests.

In Colorado, there are 22.5 million acres of forest land. It is neither economically feasible nor even desirable to treat all of this land. Factors such as visual quality, forest diversity, minimizing runoff, and road density all must be considered in deciding where and how to manage. It is critical that the relatively small percentage of



Thinning and harvesting forests improves growing conditions by making more light, nutrients, and moisture available.



Real estate agents in Summit County are now including mountain pine beetle in their disclosure reports to property buyers.

Colorado's forests that can be managed is strategically located to provide social and ecological benefits.

Forest management is a commitment over time, not a one-time fix.

To make forest management decisions, it is important to consider what the individual landowners need (community scale) as well as what the landscape needs (ecosystem scale). Coloradans benefit from management of both.

At the community scale, protection of life and property is the top priority. Other values may include privacy, scenic views, watersheds, and wildlife observation. Around homes and in



subdivisions, it is not as critical that forest management techniques mimic ecological processes to achieve these objectives. By protecting themselves from wildfire, communities also help prevent firefighter injuries and reduce financial burdens to fellow taxpayers for fire suppression costs.

On the ecosystem scale, a mix of forests with species and age diversity, meadows, and riparian vegetation can result in a more resilient landscape.

Maintaining diversity in landscapes can help retain areas of older forests.

Research shows that thinning, commercial timber harvesting and prescribed burning can make forests more resilient, and reduce the adverse effects of wildfires and insect and disease epidemics. For maximum effectiveness, these activities must be implemented across ownership boundaries at a landscape scale and continued over time.

How Can People Manage for the Next Forest?

- Adding diversity to forests can provide a kind of insurance policy against future large-scale multi-landscape disturbance events.
- Thinning around homes and communities helps reduce fire risk in communities and watersheds.
- Creating naturally-shaped openings in lodgepole pine forests over time reintroduces age and spatial diversity.
- Removing conifers from aspen stands provides excellent wildlife habitat and helps prolong aspen on the site.
- Thinning and creating openings in ponderosa pine forests improves vigor in remaining trees, enabling them to better resist damage from wildfire, insects and disease.
- Maintaining forests over time helps keep them resilient.



Lodgepole pine forests with age diversity, pictured above, are more resilient to insects and wildfire.



Insect and Disease Activity Update¹

The continued infestation and mortality of forests from bark beetle outbreaks dominated the news with regard to insect and disease activity in Colorado during 2006. Both mountain pine beetle and spruce beetle continue to turn high country forests from green to red, a trend that is being repeated to a lesser extent in the Front Range. In western Colorado, the persistent aspen die-off continues to puzzle researchers.

Mountain Pine Beetle

Colorado is experiencing the largest outbreak of mountain pine beetle in its recorded history. In 2006, this forest

insect infested over 660,000 acres in the state, up from 500,000 acres in 2005. There were about four times as many recently killed trees per acre in 2006 than 2005.

Mountain pine beetle is killing pine trees throughout the West. The unusually large and intense outbreaks are spreading further north and in higher elevations than seen before. In Canada, the epidemic is far more intense and extensive than anything previously witnessed by forestry officials.

The current epidemic started in Colorado's high country in the mid-1990s. When the drought of

2000-2004 occurred, it enabled beetle populations to rapidly expand in both infested and new areas.



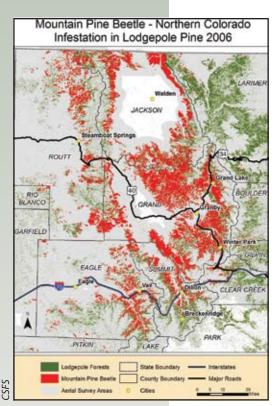
The green trees in the foreground are too young to provide mountain pine beetle a food source.

There is concern that the vast populations of mountain pine beetle will spread from north-central Colorado to the Front Range. Overcrowded Front Range forests are indeed in the early stages of a slower-growing mountain pine beetle epidemic, although their insect populations are growing independently from those of the high country.

Additional information about mountain pine beetle can be found in the *Lodgepole Pine Agents of Change* section on page 14.

Spruce Beetle

Because they primarily affect more remote high-elevation forests, Colorado's current spruce beetle outbreaks are not as well known as the mountain pine beetle epidemic. However, older Engelmann spruce forests near Carbondale, South Fork, and from Steamboat Springs north to the Wyoming border have experienced extensive mortality from spruce beetles. The northern Colorado activity resulted from a large spruce forest blowdown in



Red areas represent varying degrees of mortality.



¹ Acres and tree mortality estimates in this section were derived from the 2006 aerial survey of insects and diseases in Colorado. For bark beetles, the survey quantifies the areas that were infested in 2005 and turned red in 2006. It does not include the green trees that became infested in 2006 as these are not discernible from airplanes.

1997 at the Routt National Forest. About 68,000 acres were infested in 2006. Although this is less than the 119,000 acres infested in 2005, the reduction is partially due to previous years' activity which has left few live spruce trees to infest.

In recent years, warmer temperatures have changed the spruce beetle's life cycle from two years to one, allowing them to spread more quickly. This bark beetle is also affecting other western states. Utah has experienced extensive spruce mortality in recent years, and Wyoming is currently in the midst of an outbreak in the advanced stages. In Colorado, this epidemic is changing the face of today's old spruce forests.



With the large areas of standing dead trees, officials are concerned about future threats of falling trees to roads, trails, powerlines, buildings and campgrounds.



Aspen Decline

For the second year in a row, unexplained aspen decline occurred in western Colorado. Despite many on-site inspections, experts have not determined what is killing the trees and their root systems. Common culprits such as animal grazing and conifer encroachment are not responsible for this ongoing die-back. About 138,000 acres of aspen decline and mortality were observed from 2006 aerial survey flights. The extent of dying roots is unknown.

Researchers are currently designing an investigation that will attempt to determine specific symptoms and causes. If aspen root systems are unable to produce new aspen suckers, aspen clones that have existed for millennia will be lost. Preliminary assessments have shown many different causal agents, from decay fungi to aspen bark beetles, in different areas. In some cases, the decline is occurring on low-elevation, marginal aspen sites.

In some of Colorado's aspen forests, mature trees are dying without new, younger trees growing to replace them





Mountain pine beetle in Grand County.

Subalpine Fir Decline

Decline of subalpine fir is attributed to western balsam bark beetle, root diseases and other unknown factors. This decline is found sporadically throughout Colorado's high-elevation forests. More than 370,000 acres were affected by subalpine fir decline in 2006. Near Telluride, there are concerns about wildfires due to the large areas of standing dead trees on steep slopes surrounding the town.

Piñon Ips

The major piñon pine mortality from piñon ips that peaked in 2003 continues to subside in southwest Colorado. This is due to both increased moisture and lack of live piñon trees. Infestations on the Uncompandere Plateau and Glade Park are still active, although areas that received more moisture appear to be recovering.

In the southern Front Range, piñon ips increased. Over 19,000 acres were infested with piñon ips in 2006, much of which was south and west of Colorado Springs.

Western Spruce Budworm

Western spruce budworm outbreaks can cause heavy defoliation that weakens or kills Douglas-fir, true fir and spruce trees. About 93,000 acres were infested statewide in 2006. This insect has infested large areas on the eastern slopes of the Culebra Range south of La Veta Pass and on the northern slopes of the Spanish Peaks. A hot year exacerbated western spruce budworm infestations at the Uncompangre National Forest, where defoliation continues in both subalpine-fir and Engelmann spruce, with a three-fold increase from 2005 in Engelmann spruce defoliation.

Fir Engraver Beetle

Archuleta and La Plata counties in southwestern Colorado experienced an increase in fir engraver beetles. These beetles have killed many white firs that were first weakened by root disease. The scenario is a classic result of fire suppression as white firs have proliferated in areas where they would have been burned by periodic natural fires.



Lodgepole Pine

Overview

Lodgepole pine is a widespread species, growing throughout the Rocky Mountain and Pacific Coast regions. This report will focus on the Rocky Mountain variety found in Colorado.

Most of today's lodgepole pine forests regenerated after widespread fires and some logging activity in the mid to late 1800s and early 1900s. As a result, many of these forests are filled with trees of roughly the same age, from 100 to 150 years old.

Relatively few new stands have become established since the turn of the twentieth century, leaving very little age diversity in Colorado's lodgepole forests.

Lodgepole pine's tall, straight and strong wood makes it valuable for a variety of uses, from rustic fences to commercial timber. The lodgepole pine forest type provides breathtaking mountain views and recreational opportunities. Many of Colorado's premiere ski destinations, including Winter Park and Vail, are located in lodgepole pine forests.

By providing habitat for elk and deer, these forests also contribute to many rural economies during fall hunting seasons. In Colorado, hunting and fishing is a \$1.6 billion industry. High-elevation forests, including lodgepole pine, also provide habitat for lynx, a federally listed threatened species.

Characteristics and Ecology

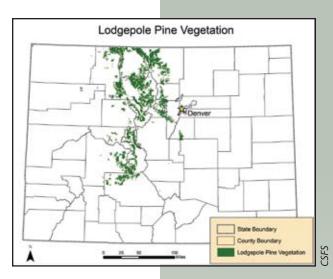
Lodgepole is a two-needled pine that grows at elevations from about 8,000 to 10,500 feet. Mature trees have a very straight trunk, a narrow crown, and no lower branches. The average lodgepole pine in Colorado is about 40 to 80 feet

tall, 8 to 12 inches in diameter, 130 years old and has a 160-year life span. The oldest known lodgepole pine in Colorado is over 350 years of age.

Lodgepole pine primarily grows in pure, dense, even-aged stands but is sometimes mixed with other conifers. It overlaps with

ponderosa pine and Douglas-fir at the low end of its elevation range and with Engelmann spruce and sub-alpine fir at its upper limits. It also competes with aspen in many locations. Like aspen, lodgepole pine is shade intolerant and grows best in full sunlight, often on northern and eastern slopes.

Lodgepole pine is one of the most aggressive and hardy of western forests. It has an amazing potential to



Forests dominated by lodgepole pine cover about 50 million acres in Canada and about 15 million acres in the U.S. There are about 1.5 million acres of lodgepole pine forests in Colorado.

Lodgepole pine seeds germinate and survive best in a harsh, exposed environment.



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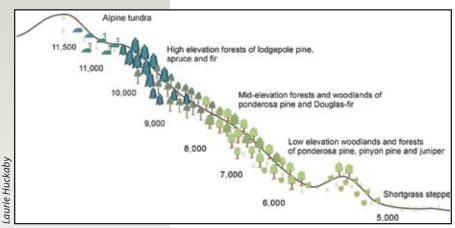
Stagnated lodgepole pine stands are sometimes referred to as "doghair" because they are thick and dense like hair on a dog.

pioneer and invade disturbed sites and meadows.

The Life Cycle of Lodgepole Pine

Lodgepole pine has rapid early growth and abundant seed production. The species is sometimes said to "live fast and die young" because it grows vigorously at first and then naturally overcrowds itself. It is usually killed by wildfire or mountain pine beetle before it reaches 150 years of age.

Lodgepole pine is an uppermontane forest.



Wildfire has been the primary regenerating force for Colorado's lodgepole pine. Historically, wind-driven crown fires up to tens of thousands of acres would kill the entire forest canopy and expose bare mineral soil, providing an optimal seedbed.

Lodgepole pine's cones have a noteworthy adaptation to wildfire that has helped propagate the species. The *serotinous*, or closed, cones have resin that holds seeds and protects them during wildfires. This provides an aerial seedbank that is viable for decades. Fire's heat melts the resin, opening the cones and releasing their seeds where they can grow in full sunlight. Within several years after a fire, a carpet of seedlings will re-establish lodgepole pine in the burned area. This natural regeneration process can be similarly achieved with a timber harvest.

Wildlife Associated with Lodgepole Pine

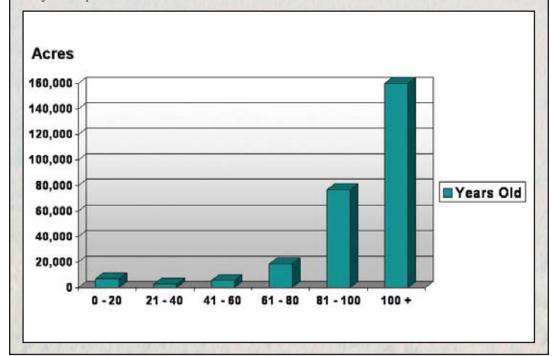
Plant and animal diversity is usually low in mature lodgepole pine stands, but these dense forests provide cover for elk, deer and bears as well as for squirrels and other small mammals. Richer flora and fauna are associated with young lodgepole forests.

Elk

Elk need *security cover* or screening at the base of trees. An aggressively thinned 20- to 40-year old lodgepole stand is good elk habitat because individual tree canopies remain full. The animals will also use older, dense lodgepole stands for cover, especially where there are nearby meadows with grass to eat. Forest openings of 10 to 30 acres are optimal for elk, providing both cover and feeding areas.

Why Are Colorado's Lodgepole Pine Forests so Uniformly Aged?

From the mid-1800s to early 1900s, wildfires burned in many of Colorado's lodgepole pine forests. In 1851 alone, wildfires burned thousands of acres in what is today Rocky Mountain National Park. At around the same time, timber harvesting and some prospecting fires further changed the landscape. The subsequent regeneration led to today's vast swaths of 100- to 150-year old forests. These mature lodgepole pine forests, even those that have not been killed by forest insects, are very susceptible to wildfire.





Lodgepole pine's closed cones remain on trees and release seed after a fire or timber harvest.

Lynx and Snowshoe Hare

Colorado is in the most southerly edge of snowshoe hare habitat and thus Canada lynx range. Although spruce/fir forests are preferred by these animals, young lodgepole pine forests can provide suitable habitat. Lynx is on the state's endangered species list and is federally listed as threatened.

Snowshoe hare eat buds, including those of lodgepole pine, for a large part of their diet. They also need security cover from birds of prey. Trees with

branches reaching the snowline can provide this cover and food source. As lodgepole pine forests mature, they self-prune their lower branches, and no longer provide enough cover or food to support the hare. In unmanaged forests, 20- to 40-year old lodgepole pine stands can meet snowshoe hare's habitat requirements. If thinned when young, lodgepole pine forests can provide critical food and cover for far longer than unmanaged stands.



Because the vast majority of Colorado's lodgepole pine forests are old, suitable stands for snowshoe hare habitat are rare.







Since the Colorado
Division of Wildlife began
reintroducing moose to
North Park from Utah and
Wyoming in the 1970s, a
successful population has
grown. Moose primarily eat
willow and aspen, and use
lodgepole pine forests for
hiding cover.

Fires in lodgepole pine typically burned thousands of acres of forest at a time. These naturally intense fires can threaten mountain communities, whether or not surrounding forests have been killed by mountain pine beetle.

Pine Marten

Where they mix with spruce/fir, older lodgepole pine forests provide habitat for pine marten, a mammal in the weasel family. The pine marten is an *old forest obligate*; it needs older forests with downed logs for its habitat.

Agents of Change

The interactions of mountain pine beetle, diseases, and wildfire add complexity to the seemingly simple lodgepole pine forest ecosystem.

Wildfire

Stand replacing crown fires are an integral part of lodgepole pine forests. These fires consume an entire forest, making room for the next generation of trees to grow.

Colorado's lodgepole pine forests have historically burned about every 100 to 300 years, with forests in the highest elevations burning less frequently. In Colorado, these large fires ranged from several hundred to tens of thousands of acres. The state's topography and rocky

outcrops break up forest fuels, and thus lodgepole pine fires did not typically grow as large as those in Oregon, California and Wyoming.

There were extensive fires in Colorado's lodgepole pine forests in the second half of the 1700s and the second half of the 1800s. Despite this pattern, Colorado's high elevation lodgepole pine and spruce/fir forests have been known as "asbestos forests," because in recent memory they have rarely burned.

When subjected to lightning, an older forest with dead and down wood is more likely to catch fire and burn than a young forest with less woody material.

However, wildfire in lodgepole pine forests is always a very real threat that grows increasingly likely the longer it has been since fires burned. Colorado's lodgepole pine forests are already laden with fuel, and if warming temperature trends continue, this fuel will become

Lodgepole Pine Crown Fire



Ponderosa Pine Surface Fire



n Chase

While most fires in ponderosa pine historically burned on the forest floor, lodgepole pine fires naturally burn as a crown fire. Crown fires burn in the forest canopy, spreading from treetop to treetop. These wind-driven fires often occur in the driest conditions and are almost impossible to control.



The Aftermath of Wildfires



In the four years following the 2002 Hayman Fire, the Denver Water Board has spent over \$7.8 million to remove debris, replace culverts, build sediment dams, stabilize slopes, and improve water quality. Additional sediment removal from Strontia Springs, one of Denver's reservoirs, will cost many additional millions of dollars. These expensive efforts include combating effects from the 1996 Buffalo Creek Fire, which burned in the same watershed.

Jen Chase

very dry making fires almost certain. The effects of these intense fires on life, property, and water supplies can be costly in many ways.

One of the most intense types of wildfires in lodgepole pine forests can occur when a growing forest has a large build-up of logs lying on the ground. Digging fire line through downed logs is arduous, making the fire hard to control. Heavy fuels can increase a wildfire's severity and result in damage to soil and watersheds, depending on summer rains and snowmelt following the fire. Cleaning up drinking water reservoirs after these intense fires can cost millions.



Fire intensity in lodgepole pine is its most extreme in forests with fallen logs.



Mountain Pine Beetle

Mountain pine beetles are the most aggressive insect affecting mature pines in western North America. Within a year of successful attack, the infested tree is dead, and the next generation of beetles flies to new host trees.

Mountain pine beetles are always present in Colorado's pine forests, normally attacking weak and injured mature trees. However, when forest and weather conditions are suitable for population growth, large outbreaks can occur. This may happen about every 10 to 30 years. During epidemics, one attacked tree may produce enough beetles to attack multiple trees the following year, resulting in an exponential increase in dead trees.

Beetles attack green trees, where they chew through the bark to lay eggs. The eggs hatch, eat the tree's inner bark, and infect the tree with

Stand Conditions Susceptible to Mountain Pine Beetle

- Trees at least 80 years old
- Trees at least 8 inches wide (pictured, right)
- Crowded stands
- Many old trees in a stand
- Many trees in the stand that are over a foot wide









microorganisms, including a distinctive blue-stain fungus, which eventually blocks the tree's water movement. The tree's needles won't turn red until the following spring and summer. It is about this time that the next generation of beetles exits its dead host tree and flies to reproduce in living trees.

Mountain pine beetles in Colorado have crossed an elevational threshold that has not been seen before. Until the recent warmer weather, mountain pine beetles have not been able to withstand the cold temperatures

above 9,500 feet. But at the USDA Forest Service's Fraser Experimental Forest (elevation 9,000-12,800 feet), some of Colorado's oldest lodgepole pine trees are now being killed by these beetles. Although these stands have been at a susceptible age for over two centuries, they have not been impacted by mountain pine beetle until the current outbreak.

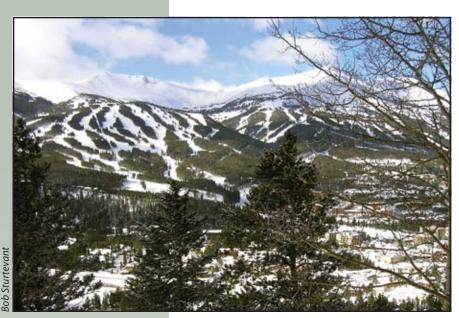
Mountain pine beetle is a significant cause of fuel buildup in lodgepole pine forests and can result in very intense fires. Initially, the dead, dry needles on a tree can catch fire easier and spread the fire more quickly than green needles with more moisture. After 10 or 15 years, beetle-killed trees will fall and can burn very intensely.



Mountain pine beetle in larval stage.

When pine trees reach eight inches in diameter, as shown here, they are large enough for mountain pine beetle to successfully infest. It takes lodgepole pine trees at least 80 years to grow to this size.





At ski areas, live trees provide aesthetics, wind protection and a quality experience. Years after they are dead, however, lodgepole pines' notoriously shallow roots will give out, and trees will pose a safety risk to skiers and boarders.

Dwarf Mistletoe

Dwarf mistletoe is the most damaging disease agent to the pine species, causing severe growth loss, tree deformity and increased tree mortality. It is widespread in lodgepole pine of all ages, but its effects build over time. Dwarf mistletoe weakens the trees' resistance to mountain pine beetle as well as contributes to fuels for future fires.

Dwarf mistletoe infection leads to:

- Abnormal branching and "witches' brooms"
- Tree mortality by increasing trees' susceptibility to other damaging agents
- Decrease of host trees' seed production
- Losses in wood production and quality

Lodgepole Pine Management

Management activity in lodgepole pine forests can reduce fire risks to homes and communities, produce commercial wood products and restore diversity and resilience across a landscape. Management techniques include thinning of young forests, cutting large openings in the mature forest to create age and spatial diversity, and allowing naturally ignited fires to burn. It is important to understand what outcome is desired prior to outlining a forest management strategy.

Despite its relatively small diameter, lodgepole pine can grow large enough for commercial timber. Its thin bark, coupled with its straight form, gives the tree a higher volume of wood for its diameter and height than many other trees.

Lodgepole pine can be sustainably produced and can play an important role in local economies. It is a species that is easily managed and responds well to forest treatments. Despite its many potential benefits and uses, far



Different aged forest stands can provide visual variety in an otherwise homogeneous landscape.



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more lodgepole pine is being killed by mountain pine beetle than is currently harvested for either forest products or fire risk reduction. Although Colorado uses over 1.1 billion board feet of lumber every year, only about 7% of that is harvested in the state.

Some reasons why mountain pine beetle killed trees are not commercially in-demand include:

- Beetle killed lodgepole pine trees deteriorate and lose their value as lumber very quickly.
- The bluestain fungus introduced by the beetle discolors the wood. Although this doesn't affect the strength of the wood, the staining is a visual defect that lowers its timber value.
- Small, local mills are at their capacity to process the large available volume of logs.
- Dead logs weigh less than live ones, and loggers selling by weight may not make enough money to haul dead logs to distant mills.
- There may not be enough awareness to create a demand for Colorado wood products.

Thinking globally and buying wood locally not only provides local jobs, it reduces the pollution generated by shipping wood from other states and countries. B



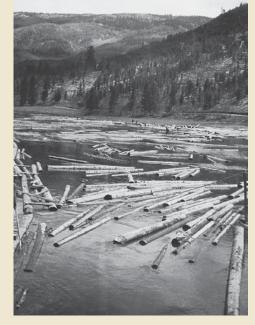
wood from other states and countries. By purchasing local forest products, citizens can also reduce the costs of forest treatments needed to make Colorado's forests healthier. See www.coloradoforestproducts.org for more information.

Forest Products from Lodgepole Pine Telephone poles 4 House logs Log furniture and railing Fencing Tongue and groove paneling Decking Structural plywood

Lodgepole Pine: Part of Colorado's History

In the late 1800s, much of Colorado's demand for railroad ties was supplied in lodgepole pine forests. Men would hand-fell and hand-hue the railroad ties, skid them by horses with sleds, and stack them by streambanks to later be sent downriver.

Isolated yet selfsufficient communities of "tie camps" dotted Colorado's river valleys from about 1870 to 1930, especially in the Summit County and Leadville areas. Cabins, a store,



a cookhouse, some skill shops and a school accommodated hundreds of workers and some families in these isolated towns.



The second of th

Unlike ponderosa pine, which has a deep taproot, shallow-rooted lodgepole pine can blow over easily when mature stands are thinned.

Management Techniques

Clearcutting or Even-Aged Management

A clearcut is an area where all trees have been removed. This technique is often used in *even-aged management* because it is an excellent means of regenerating even-aged species like lodgepole pine. A clearcut area can be designed to provide optimal habitat for wildlife, and can be shaped to blend naturally with topographic or other features.



Foresters may specify that some large woody debris remain in contact with the soil to foster nitrogen storage in resulting decayed wood and to promote beneficial microbial activity in the soil.

Harvest operations mimic, on a smaller scale, the disturbances that naturally regenerate lodgepole pine. Equipment exposes the mineral soil that lodgepole pine needs as a seedbed. Closed cones fall to the forest floor and cone-bearing branches are scattered during harvest operations, releasing their seeds in the following summer's heat and leaving an open, sunlit area for them to grow.

Thinning Young Lodgepole Pine Forests

Thinning young lodgepole pine stands increases tree vigor and postpones self-pruning, the natural loss

of lower tree branches that happens when trees grow into each other. Thinning young stands can also result in wildlife habitat enhancement and improved future timber harvests.

Thinning Mature Lodgepole Pine Forests

Thinning in mature lodgepole pine forests is not recommended for many reasons. Unlike when young trees are thinned, the vigor and growth of older trees does not improve significantly with the increased sunlight, nutrients and water. Many older lodgepole pine stands are infected with dwarf mistletoe, and trees left in the cut area will quickly infect the new seedlings. Additionally, shaded areas result in poor regeneration.

Other considerations for managing lodgepole pine include windthrow, or blowdown. Trees in dense lodgepole forests depend on neighboring trees to buffer strong winds. If stands are suddenly opened by excessive thinning, trees may blow over due to lodgepole pine's shallow roots.

Thinning mature lodgepole pine forests is an appropriate way to reduce wildfire hazard near communities.

Fire Use

Unlike prescribed fire, *Fire Use* is a fire that starts by lightning and is managed for natural resource benefits. Wilderness areas, where natural processes are intended to take their course, are places where natural ignitions are sometimes managed as Fire Use fires.

Although managing wildfire would most closely mimic natural processes, it can be complex, dangerous and expensive near communities. In these cases, Incident Management Teams, also called fire teams, may help manage Fire Use fires. These teams direct firefighter crews to protect structures and cultural and natural resources in advance of the fire; monitor fire behavior; and suppress the fire in areas where managers want to keep it from burning. There are less than ten National Fire Use Management Teams, including the Rocky Mountain Team that is primarily based out of Colorado.

Prescribed Fire

Although it can be done, extensive planning and preparation work is required to use prescribed fire in lodgepole pine forests. Because they naturally burn as crown fires, instituting control measures on burn unit boundaries ahead of time is critical. Under specific circumstances, prescribed fire can be a safe, effective means of managing lodgepole pine forests, but it is a rarely employed, difficult technique. The only place in Colorado that has had a long-term prescribed crown fire program in lodgepole pine is at the Gunnison National Forest. For more detail on this program, see Areas of Lodgepole Pine Management on page 21.

Fuels Reduction around Communities

Wildfire mitigation is critical in all forested communities because fire is a fact of life in Colorado, with or without beetle-killed trees. Wildfires historically burned in lodgepole pine forests during extremely dry and windy conditions.

Increased development in high risk forests also increases the need for wildfire mitigation activities.

Protecting communities from crown fires requires extensive thinning around

Clearcutting: The Ugly Duckling of Forest Management?

No silvicultural practice is more controversial than clearcutting. Indeed, clearcuts may appear stark and barren for several years before new growth provides a more vibrant look. One glance at an unsightly or ill-planned clearcut area can convince people that the practice is devastating, regardless of evidence to the contrary.

In even-aged, disturbance-dependent forests like lodgepole pine, clearcutting can effectively emulate wildfire. It regenerates the forest, creates diversity on the landscape and provides wildlife habitat. Economic benefit can also be gained by harvesting this renewable resource rather than burning it up.



In the midst of the huge swaths of brown and red beetle-killed trees, clearcut areas of live, young, green trees are greatly appreciated.

homes and communities as well as building with fire resistant materials.

When homes have defensible spaces and the forests surrounding communities are thinned, not only will the communities be better protected, but firefighters will be safer too.



Areas of Lodgepole Pine Management

Colorado State Forest

The Colorado State Forest is a unique state trust property located about 80 miles west of Fort Collins in North Park. Stretching along the western slopes of the Medicine Bow Mountains, it is known for its spectacular scenery and for being situated at the headwaters of the North Platte River. It has a long, rich history of multiple-use management that continues today.

The Colorado State Forest is currently one of the most intensely managed lodgepole pine areas in the state. A variety of state agencies

The Colorado State Forest was created in 1938 through state legislation that encourages harvesting timber in accordance with good forestry practice.

cooperate in its management. The Colorado State Forest Service manages forest resources, the Colorado State Parks manages recreation, the Colorado Division of Wildlife manages wildlife, and the Colorado State Land Board oversees grazing leases and coordinates the overall management of the property.

Like many other state trust lands, the 71,000-acre state forest generates revenue for Colorado's public schools. Timber harvesting contributes to those revenues while also enhancing forest health, wildlife habitat, recreation opportunities, the local economy, and other values.

As part of its stewardship mission, the Colorado State Forest Service conducts a variety of monitoring activities at the State Forest. These include water quality, wildlife and aquatic insects. Monitoring and baseline information are key components in adaptive management, where activities on the ground are continuously evaluated and adjusted based on feedback.

Mountain pine beetle is the current priority at the Colorado State Forest. Although past forest management has created some young, resistant forest stands, many of the lodgepole pine forests at the state forest are old and susceptible to this pervasive forest insect. As the mountain pine beetle effects enormous change in northern Colorado's forests, the need for long-term sustainable forest management is greater than ever. Years of adaptive management at the Colorado State Forest provide an excellent example of forest stewardship in action.

Northern Colorado Bark Beetle Cooperative

The Northern Colorado Bark Beetle Cooperative, formed in October 2005, consists of county and municipal governments in Grand, Eagle, Jackson, Routt, and Summit counties; Colorado State Forest Service; the Bureau of Land Management; and the U.S. Forest Service. All of these entities are seeking funding and resources from all available sources to respond to the bark beetles and the long-term fire hazards that result from widespread beetle-killed trees.

The cooperative's top priorities are to help protect life and property, infrastructure, and watersheds



from bark beetles and wildfire. Fire mitigation, tree spraying, and removing infested trees are being expedited in residential subdivisions, ski areas, business areas, and scenic corridors. Over 35,000 acres were treated in 2006 and additional work is planned in these high-priority areas. Additional efforts include researching socio-economic impacts of the bark beetle epidemics and preparing wildfire prevention and suppression strategies.

Gunnison National Forest

Incorporating stand-replacing crown fire into a prescribed burn program requires years of careful planning and preparation and the fire managers in Gunnison have an excellent track record of doing just that. From 1983 until 1999, the U.S. Forest Service had a burn plan that included 50,000 acres of lodgepole pine and spruce/fir forests in the Gunnison National Forest. The plan's primary objectives were to improve bighorn sheep habitat and kill the snail that carries lung-worm, a disease that can weaken or kill sheep. Meeting these objectives also reduced fuel build-up, protected watersheds, and allowed crown fire to return to fire-dependent forests.

Bighorn sheep prefer exposed areas where they can see predators, and benefit from the openings created by crown fires. They also eat the succulent, nutritious plant growth that follows. When there are many open areas with ample, low-growing vegetation, the herd spreads out. This reduces the chances that an illness might wipe out all of the sheep at once.

Depending on weather and safety conditions, between 50 to 2,500 acres within the Gunnison National Forest's burn plan area were burned each



Bighorn sheep are magnificent yet sensitive animals that are subject to population crashes under certain conditions.

year. First, experienced firefighters created fire unit boundaries by burning vegetation along topographic breaks and snow-covered areas. These buffer areas were from a half mile to several miles wide. Later, during drier conditions, the forested interior was lit on fire by helicopter and from the ground. Crown fires then burned from treetop to treetop and via spotting. Spotting occurs when winds carry burning embers in front of a fire, allowing it to spread to unburned areas. The boundary areas were designed to be wide enough to prevent embers from starting a new fire outside the prescribed fire unit.

Fire managers are currently writing a new burn plan that would continue earlier successful efforts to improve bighorn sheep habitat. Although there are risks and smoke management concerns, if these areas are not managed, consequences are grave for bighorn sheep. If they stop migrating, they will become more susceptible to stresses and illnesses, and the success of the herd may be jeopardized.



Conclusion

Coloradans have both the opportunity and responsibility to shape the state's forests for the next 5, 50 and 100 years. If these forests are not carefully considered, planned for and appropriately managed, future wildfires and insect outbreaks will continue to create more burned, overcrowded and beetle-killed trees than most people would like.

The need to manage vital forest resources becomes more critical as land is increasingly developed and fragmented at the same time that society's demands on these resources are growing.

Just as warming temperature trends, drought, and old, crowded forests are a recipe for a widespread mountain pine beetle outbreak, warmer weather and a relatively long fire-free interval in Colorado's lodgepole pine forests

make a perfect storm of conditions for wind-driven crown fires. Proactive forest management activities can limit impacts to communities and watersheds from these events.

The current interest in healthy forests generated by the massive mountain pine beetle mortality has provided a window of opportunity for broader consideration and better management of Colorado's forests.

Well-planned forest management, however, is a long-term endeavor and an investment in time and resources. It has taken years for forests to become old and overcrowded, and it will take years to create resilient, vigorous forests. But by making a long-term commitment in these renewable natural resources, Coloradans' economies and quality of life will benefit tremendously, today and tomorrow.







References and Additional Reading

- Aguayo, Ingrid. 2006. Colorado Insect and Disease Report. Fort Collins, Colo.
- Brown, James K. 1973. Fire cycles and community dynamics in lodgepole pine forests. In: Symposium proceedings: Management of Lodgepole Pine Ecosystems. David M. Baumgartner, editor. Washington State University. 429-456.
- Burns, Russell M., and Barbara H. Honkala, tech. coords. 1990. Silvics of North America: Volume 1. Conifers; Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. 1,383 p.
- Cole, Walter E. and Gene D. Amman. 1980. Mountain pine beetle dynamics in lodgepole pine forests. Part I: course of an infestation. General Technical Report INT-89. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 56 p.
- Despain, Don G. 1973. Lodgepole pine ecosystems as producers of recreation. In: Symposium proceedings: Management of Lodgepole Pine Ecosystems. David M. Baumgartner, editor. Washington State University. 278-284.
- Ellsworth, E. and T.D. Reynolds. 2006. Snowshoe Hare (*Lepus americanus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/snowshoehare.pdf. 68 p.
- Harlow, William M., Ellwood S. Harrar, James W. Hardin, Fred M. White. 1991. Textbook of Dendrology. Seventh edition.
- Hess, Karl and Robert Alexander. 1986. Forest Vegetation of the Arapaho and Roosevelt National Forests in Central Colorado: A Habitat Type Classification. USDA Forest Service Research Paper RM-266.
- Hoover, Robert L. and Dale L. Wills, editors. 1987. Managing forested lands for wildlife. Colorado Division of Wildlife. 459 p.
- Kitzberger Thomas, Peter M. Brown, Emily K. Heyerdahl, Thomas W. Swetnam, and Thomas T. Veblen. 2006. Contingent Pacific-Atlantic Ocean influence on multi-century wildfire synchrony over western North America. Proceedings of the National Academy of Sciences.
- Koch, Peter. Lodgepole Pine in North America. Volume 1: Background. 1996. Forest Products Society. 343 p.
- Koch, Peter. 1996. Lodgepole pine commercial forests: An essay comparing the natural cycle of insect kill and subsequent wildfire with management for utilization and wildlife. U.S. Department of Agriculture, Forest Service. General technical report INT-GTR-342. 24 p.
- Litton, R. Burton. 1973. Esthetic resources of the lodgepole pine forest. In: Symposium proceedings: Management of Lodgepole Pine Ecosystems. David M. Baumgartner, editor. Washington State University. 285-296.



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Lotan, James E. and David A. Perry. 1983. Ecology and Regeneration of Lodgepole Pine. Agriculture Handbook 606. U.S. Department of Agriculture, Forest Service, Washington, DC. 51 p.

Lotan, James E., James K. Brown, and Leon F. Neuenschwander. 1984. Role of fire in lodgepole pine forests. In Symposium Proceedings: Lodgepole pine: The species and its management. David M. Baumgartner et al., eds. Washington State University.

Lotan, James E. and William B. Critchfield. 1990. Pinus contorta Dougl. ex. Loud. lodgepole pine. In: Silvics of North America. Volume 1. Conifers. Agric. Handbook. 654. Washington, DC: U.S. Department of Agriculture, Forest Service.

Online Resource:

Biology, Ecology, and Management of Western Bark Beetles. U.S. Forest Service. Rocky Mountain Research Station. Online: http://www.usu.edu/beetle/publications_bark_beetle.htm



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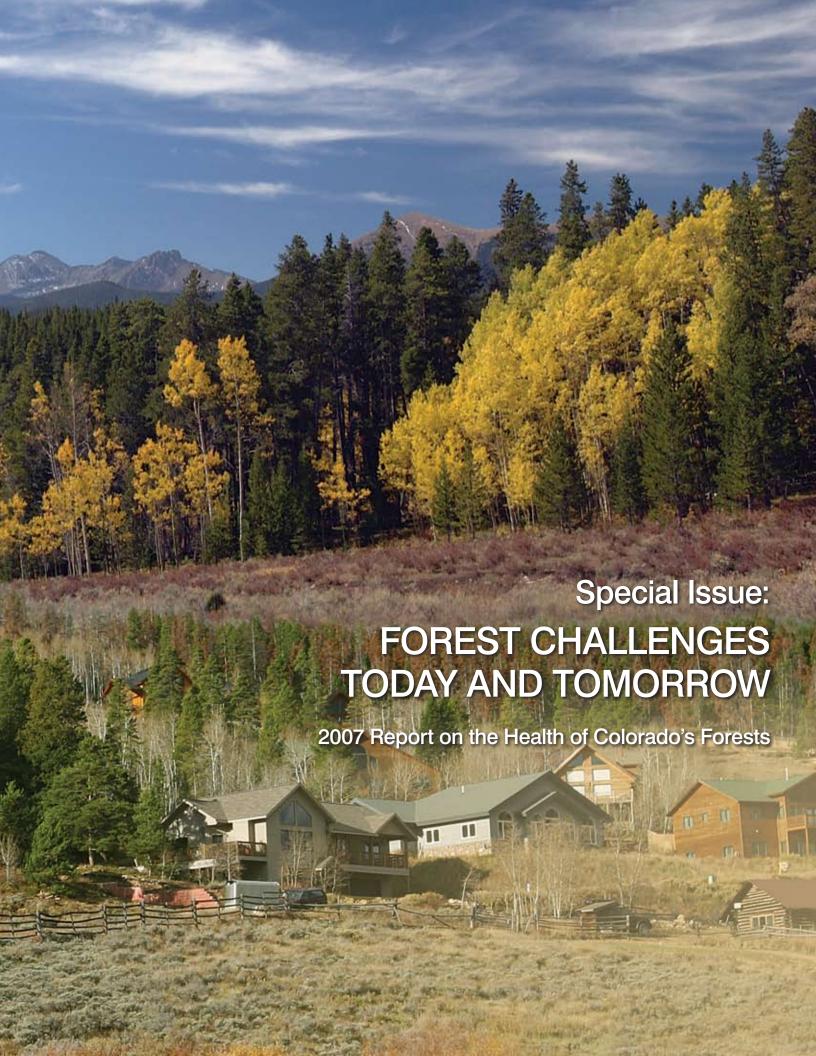
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February 2008

The 2007 Report on the Health of Colorado's Forests comes at a time when unprecedented changes are occurring in our natural environment. Never before have we experienced forest health issues of such multitude and magnitude. The health of our forests has immediate and long-term impacts on our communities and economies. Now, more than ever, what is happening to our forests affects all of us, from cities and suburbia, to rural dwellers.

Because this is a critical time for our forests, this year's report provides a look into our future forests and how Colorado's people and forests overlap. It is a forward-looking document that will help guide our decisions and policies.

Bringing a broad spectrum of forest health issues to light is the purview of this report. Taking action is the responsibility of Colorado's citizen and government leaders. Our actions will shape future forests, and thus the benefits that forests provide us.

Please contact the Colorado State Forest Service office nearest you if you are interested in learning more about forestry and what you can do to help restore and protect our forests. Now is the time to move forward, toward healthy and diverse future forests.

Sincerely,

Jeff Jahnke

State Forester

Colorado State Forest Service

Table of Contents

Colorado's Wildland-Urban Interface, Current and Projected	Foldout
Firebreak Helps Firefighters Save YMCA Camp and Subdivision	Foldout
Executive Summary	2
Colorado's Forests Today	4
Forest Benefits	4
Insect and Disease Activity Update	6
Urban and Community Forests	10
Riparian Forests	12
Forest Challenges: Today and Tomorrow	14
Climate Change	14
Forest Fragmentation and Development	16
Fire Suppression	18
Today's Solutions for Tomorrow's Forests	20
Forests Countering Global Warming	20
Industry Infrastructure	21
Woody Biomass	22
On-the-Ground Successes	23
2007 Forestry Legislation	25
Actions and Strategies for Healthy Future Forests	27
Conclusion	28
References and Further Reading	29
Acknowledgements	30

Executive Summary

Colorado's forests are on the cusp of dramatic change. This report provides a look ahead at issues that are likely to impact Colorado's forests and the benefits they provide – benefits such as clean water, clean air, diverse wildlife habitat, thriving recreation-based economies, and quality of life.

Declining forest health and extended wildfire seasons linked to climate change are pressing issues in Colorado. Forest fragmentation and development also are detrimental to the state's forests. Additionally, decades of fire suppression has left a legacy of unnaturally dense forests in some areas. This has increased the need to invest in programs that will help protect lives, property, and vulnerable resources from potentially catastrophic wildfires that result from accumulated fuel build-ups.

Because much of Colorado's forest lands are old and unmanaged, they are

prone to insect and disease epidemics, and wildfires. Although Colorado's forests are disturbance-driven and should naturally be characterized by diversity in age and size, past decisions have resulted in forests that are homogenous at a landscape level, making them vulnerable to widespread damage.

In recent years, Colorado's forests have experienced several large-scale insect infestations, from ips beetles in the piñon forests of southwestern Colorado to mountain pine beetles in northern lodgepole pine forests. In both cases, the infestations have or will result in tree mortality rates that exceed 90 percent. And Sudden Aspen Decline (SAD) more than doubled in Colorado from 2006 to 2007, increasing from 139,000 to 334,000 acres.

Spruce beetle likely will be Colorado's next statewide forest insect challenge, and outbreaks are expanding in many locations

Thirty Colorado teachers learn about fire and forest ecology at the Fire Ecology Institute for Educators in July 2007. The 1,240 acre New Castle Fire, which burned northwest of Glenwood Springs in June 2007, provided a fresh fire example, complete with wood-boring insects that start post-fire recovery.







In the coming decades, Colorado likely will experience longer and more severe wildfire seasons, issues with water quality and quantity, and reduced snow quality for skiing and other winter sports.

throughout Colorado. In addition, the presence of western balsam bark beetle and root diseases, which are native to subalpine fir forests, has increased during the past decade or two.

Threats to urban and community forests also are on the rise. Salts used to de-ice roads continue to weaken roadside trees such as maples, lindens, and elms. And black walnut mortality is killing urban walnut trees in several Colorado cities and towns. Although there have been no confirmed cases of emerald ash borer in Colorado, foresters are concerned about this exotic insect, which has the potential to kill many of the 4 million native and planted ash trees in the state.

Tamarisk and other invasive trees such as Russian-olive also threaten Colorado's riparian forests. Although this represents only about 1 percent of the state's total forested area, these forests provide essential benefits disproportionate to their size and are critical to the livelihood of Colorado's agricultural communities.

In addition to specific current conditions, broader challenges likely will

affect Colorado's forests over the next 10-15 years and beyond. Climate change, forest fragmentation, and fire suppression will continue to disrupt the state's forests in many ways.

Natural resources are among Colorado's most valuable assets and are worthy of protection and stewardship. Increasingly, Colorado's forests need to be managed to address contemporary and emerging issues including forest health, wildfire, carbon sequestration, potential climate change, and biomass energy. Management also must ensure the continuance of the broad array of ecosystem services upon which the public's welfare depends. These goals cannot be attained by a hands-off, leave-it-to-nature approach. They require careful planning, collaboration, and action.

Although the challenges Colorado's forests face may be daunting, they are not insurmountable. They do, however, require consensus and political resolve to fix. Ensuring the continuation of the benefits that our forests provide, and that Coloradans depend on, is critical to Colorado's future.

Colorado's Forests Today

Forests enhance water quality by filtering contaminants, absorbing and storing excessive nutrients, and reducing flooding.



Forests benefit Coloradans in many ways. However, climate change effects, fragmentation and development of forestlands, and ecological impacts from fire suppression put these benefits at risk. Protecting our forests can help ensure that they continue to provide benefits through time.

Forest Benefits

In addition to providing water that helps produce our food, forests also reduce air pollution and strengthen the state's recreation-based economy. In other words, forests contribute to quality of life for all Coloradans. Colorado is synonymous with the great outdoors, offering recreational possibilities so varied and plentiful that they attract visitors from all over the world.

Clean Water

Most of the water that Coloradans use flows from forested watersheds. These forests play a critical role in the state's water supply. Tree roots slow down runoff, allowing water to seep into the ground. This recharges soil moisture and maintains groundwater. Forest cover also protects snow and prevents it from melting prematurely. Colorado is considered a *headwaters* state, because snowmelt from the Rockies provides drinking and agricultural water to several other states.

Promoting healthy forests is an excellent investment in preserving the state's high-quality water supply. Healthy forests reduce the potential after-effects of extreme wildfires, such as clogged reservoirs and damaged water facilities. This benefit is even more vital when considering the growing demands on the finite sources of water in the West.



Clean Air

Clean air is another essential benefit forests provide. Forests absorb chemicals such as nitrogen oxide, sulfur dioxide, and carbon monoxide. They also reduce greenhouse gases by using atmospheric carbon dioxide during photosynthesis.

Economic Benefits

A ski area exemplifies forests managed for recreation to yield economic benefits. Many ski runs were developed by creating clearcuts between areas of protective trees that shelter skiers and snow from wind. According to a 2004 Economic Impact Study by Colorado Ski Country USA, skiing brings \$2 billion per year to Colorado.

In addition to sustaining recreationbased economies such as skiing and hunting, forests attract tourists seeking opportunities to view wildlife and Colorado's fall colors, which generates significant revenue for the state.

Forest Benefits at Risk

The continued ability of our forests to provide valuable assets such as those detailed above is increasingly threatened by residential development, effects from climate change, and wildfire.

The condition of Colorado's forests elevates these threats. Many of the state's forests are old and lack the resiliency of young stands, which represent our future forests.

Because much of Colorado's forests are old, unmanaged and fire-prone, they are less resilient to the effects of insects and wildfires. These disturbances can compromise the state's water supply and threaten other benefits our forests provide. Although Colorado's forests are disturbancedriven and should naturally be characterized by diversity in age and size, past decisions have resulted in forests that are homogenous



at a landscape level, making them vulnerable to widespread damage.

There is a clear need for action and coordinated efforts to safeguard and improve the benefits that forests provide. By strategically managing more of the state's forests, they will be more resilient to the increasing pressures they face today and tomorrow.

"The threat of high-severity wildfire to critical Front Range watersheds and the drinking water of Front Range communities is unprecedented."

from the Pinchot Institute's report
 Protecting Front Range Forest Watersheds
 from High-Severity Wildfires

Colorado's forests currently lack age diversity, a key component of forest health and resilience.

What is Forest Management?

Forest management includes planned activities that improve and protect forest health, reduce wildfire danger, and produce other forest benefits. Harvesting timber, removing poor quality and low-value trees, forest thinning, and prescribed fire are all examples of forest management. Other management activities, such as regulating development within fire-prone forest types, may be equally effective in improving the condition of some forests.



Removing beetle-killed trees reduces fire hazards and allows sunlight to nurture the next forest.



Young pine and aspen thrive in an area where beetle-killed trees were removed in 1999.

Insect and Disease Activity Update

Bark beetle outbreaks are normal in Rocky Mountain forests. Like mountain pine beetle, episodic outbreaks of spruce beetle have occurred for centuries in Rocky Mountain forests. Blowdowns often trigger local spruce beetle outbreaks.

However, two features of the current outbreaks appear to be unprecedented: (i) mountain pine beetle is now killing lodgepole pine at higher elevations than previously seen; and (ii) several different species of bark beetles are undergoing outbreaks at the same time, simultaneously affecting several different forest types and regions of the state. Both of these phenomena appear to be linked to the warmer temperatures that have affected forests throughout the state. Aging forests, which are present in most regions, also play a role.

Most of Colorado's lodgepole pine, aspen, and spruce/fir forests are older and less resilient. Forest insects and diseases thrive in older forests, and are responsible for the some of the dramatic changes seen in Colorado's forests today. But insects and diseases are common symptoms of older forests.

Other forests, such as ponderosa pine, have become overgrown as a result of fire suppression and lack of forest management.



These forests are more likely to be damaged by wildfire than in the previous century when low-intensity fires burned through them more regularly.

To generate a landscape-level overview of forest insect and disease trends over time, aerial surveys of Colorado forests are conducted every summer. Aerial surveying provides forest managers, elected officials, and other stakeholders an up-to-date approximation of recent conditions.

The aerial survey is a joint effort between the U.S. Forest Service and the Colorado State Forest Service. Acre estimates of insect and disease activity used in this report were derived from the 2007 aerial survey.

Mountain Pine Beetle

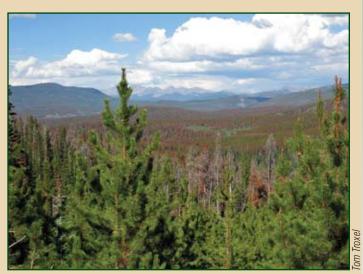
Mountain pine beetle continues to dramatically alter lodgepole pine forests in Colorado's high country. More than 980,000 acres of pine forests were infested in the state in 2007. Routt, Jackson, Pitkin, Grand, Summit, Eagle, Lake, and Park counties have experienced the most significant activity. Mountain pine beetle activity is also increasing in lodgepole stands on the Front Range, and likely will cause impacts similar to what we have seen on the west side of the continental divide.

Current mountain pine beetle populations are growing rapidly. Some surveyed areas have shown as much as a one-hundredfold increase in the number of infested trees per acre. A two- or three-fold increase in the number of infested trees in an area is more typical in mountain pine beetle outbreaks. Entomologists speculate that winds carrying beetles from nearby areas are contributing to this phenomenally high rate.

Foresters predict that most of the older lodgepole pine forests in Colorado will be infested by mountain pine beetle before this insect epidemic ends. In some areas, nearly 100 percent of the mature lodgepole pines have already been killed.

Willow Creek Pass, 2005 and 2007





Although proactive forest management would not have stopped the current mountain pine beetle epidemic, it would have resulted in more young forests that are resistant to mountain pine beetle.





In 2007, managers at SolVista ski area invested in a major tree-spraying campaign along ski runs to prevent further beetle-kill. Preserving protective tree cover helps reduce the melting and blowing snow that disrupts snow management efforts.

Mountain pine beetles also have been found attacking and killing spruce trees within and adjacent to heavily infested lodgepole pine stands. It is not known how well mountain pine beetle survives in spruce trees, but mountain pine beetle galleries, larvae, and newly formed adult beetles have been found in spruce trees. Researchers are in the process of determining whether any mature pine beetles will emerge from these spruce trees and, if so, whether the beetles are viable. Oftentimes, spruce beetle infestations also are found in the base of spruce trees attacked by mountain pine beetles.

Spruce Beetle

Spruce beetle likely will be Colorado's next statewide forest insect challenge. Spruce beetle outbreaks are expanding in many locations throughout Colorado. They may be less noticeable than mountain pine beetle because the outbreaks often occur in higher, more remote locations, and the trees fade slowly over several years. This also can make spruce beetle outbreaks more difficult to detect and map from the air.

Typically, spruce beetle outbreaks are triggered by windstorms that blow down trees over a large area. Spruce beetles breed first in the windthrown trees and then move into standing large old trees. When spruce beetle epidemics occur, spruce trees as small as four inches in diameter can be attacked.

Spruce beetles currently take two years to mature in Colorado's forests, but warmer temperatures in the spruce forests of southern Utah have allowed some spruce beetle populations in that region to shift to a one-year life cycle. If such a shift occurs in Colorado, the severity and rate of expansion of spruce beetle outbreaks could dramatically increase.

More than 97,700 acres of Colorado's spruce forests were infested with spruce beetle in 2007. Active spruce beetle

The Future Forest?

Poor genetic material can populate the next forest when smaller, unhealthy trees are left on-site after the larger, beetle-infested trees are removed. Additionally, mature trees infected with dwarf mistletoe will infect and weaken young seedlings.







A large-scale spruce beetle epidemic may have significant impacts on the state's ski areas, the upper reaches of which are all in spruce/fir forests.

outbreaks are occurring in and near blowdown areas including the Grand Mesa, the Greenhorn areas of the Wet Mountains, the Baylor Park area in Garfield County, the Steamboat Springs area, Wolf Creek Pass, and numerous other settings in southwestern Colorado. In northern Colorado, much of the older spruce from Rabbit Ears Pass north to Wyoming has been killed on the Routt National Forest.

Aspen Decline

Sudden aspen decline (SAD) is a newly described decline involving synchronized, rapid mortality of the aspen *overstory* on a landscape scale. SAD is most severe at low elevations, on drier sites such as south- and west-facing slopes, and in open stands with mature trees.

SAD more than doubled in Colorado from 2006 to 2007, increasing from 139,000 to 334,000 acres. In Colorado's national forests, SAD acreage more than tripled.

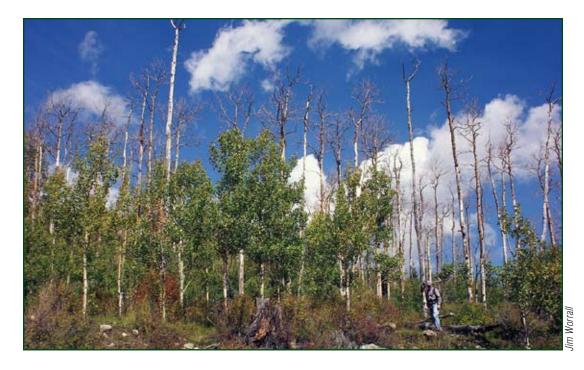
Damage is worst in the southwest and northwest portions of the mountains. In some areas, more than 10 percent of the aspen cover type is affected.

The greatest concern regarding SAD is how it affects aspen root systems. Because aspen regenerates almost exclusively by *suckering*, or root sprouting, their root systems represent future aspen forests. Long-term impacts of SAD will be determined by how extensively root systems are affected.

Although aspen regeneration is most successful following disturbance such as wildfire or cutting, some root systems are not responding to these disturbances and are in poor condition. The U.S. Forest Service recently established paired plots (declining and healthy) in southwest Colorado that will allow quantification of root sprouting, the condition of root systems, crown condition, and other variables.

Overstory trees are the tallest trees in the forest. Understory trees are the smaller trees growing beneath them.





Aspen decline on the Gunnison National Forest north of Paonia, Colo.

Maintaining and increasing tree cover is a cost-effective way to improve urban infrastructure.

Evidence points to the recent drought and warm temperatures as important inciting factors. In addition to elevation and slope direction, predisposing factors include aspen stands with mature trees. Because many old stands occur in Colorado's unmanaged aspen, much of the landscape is potentially susceptible.

Subalpine Fir Decline

Western balsam bark beetle and root diseases are native to subalpine fir forests and have been present for millennia. However, Colorado's subalpine forests have experienced increased activity during the past decade or two. Cumulative effects of these disturbance agents, known as subalpine fir decline, have led to hillsides of dead overstory trees. In 2007, 350,500 acres of high-elevation forests throughout the state were affected by this decline.

Urban and Community Forests

Communities, too, have forests. Trees along streets, in yards and parks are called urban or community forests. These forests enhance Coloradans' quality of life by:

- Purifying air and improving water quality
- Reducing runoff during storms
- Saving energy by modifying temperature extremes
- Decreasing noise pollution
- Improving aesthetics
- Providing urban wildlife habitat
- Raising property values

According to an American Forests report, urban forests in Colorado's northern Front Range metro area reduce the need for stormwater management facilities by 50.1 million cubic feet, valued at \$44 million in one-time costs, or \$3.2 million in annual savings over a 30-year period. The report also estimates that trees in the northern Front Range metro area remove 2.2 million pounds of pollutants every year, valued at \$5.3 million annually.





Like naturally occurring "wild" forests, urban forests require care to maximize tree benefits. Regular maintenance such as proper watering, pruning, and pest monitoring and control all help ensure that the trees planted in our cities and towns remain assets rather than liabilities.

Threats to Urban Forests

Roadside Salts

Many urban trees are stressed from the long-term effects of drought. Additionally, salts used to de-ice roads continue to weaken roadside trees such as maples, lindens, and elms. Chloride levels are highly elevated in some of the trees that have "scorched" brown leaves and needles.

Black Walnut Mortality

Black walnut mortality is caused by the walnut twig beetle and a fungus complex. Walnut twig beetles, which are relatively new to Colorado, traditionally attack stressed trees, infesting branches and twigs. Recently, however, they have been detected in the trunks of large-diameter trees in properly irrigated locations.

Black walnut mortality is killing urban walnut trees in several Colorado cities and towns. In 2007, Colorado Springs reported that almost all of its walnut trees were killed. The City of Boulder identified 250 black walnut trees on public and private land that must be removed by February 2008 to prevent further losses. Denver also is seeing an increase in this threat to urban forests. Colorado State University experts are conducting research about how black walnut mortality spreads and how to prevent further losses.

Emerald Ash Borer

Emerald ash borer, an insect native to northern China, continues to concern Colorado's forestry officials. Prior to 2002, the emerald ash borer had not been seen outside of Asia. But, in 2002, it was



The effects of magnesium chloride, a common road de-icer, on aspen.

identified in southeast Michigan and has since killed more than 20 million ash trees in Michigan, Ohio, and Indiana.

Although there are no confirmed cases of emerald ash borer in Colorado, the exotic insect has the potential to kill many of the 4 million native and planted ash trees in the state. Forestry officials have prepared prevention and contingency plans in case this forest insect is discovered in Colorado. Education efforts are underway to discourage importation of out-of-state-firewood because transport of infested wood is one of this insect's primary means of spreading into new areas.

Urban forests provide key benefits to Coloradans, and they need protection and care. As Colorado's urban and suburban areas continue to grow, more tree cover is needed to reduce stormwater runoff and improve air quality. Increasing the number of urban trees will enhance the environment and quality of life in Colorado communities. Additionally, planting different types of trees in community forests can help prevent major losses when exotic insects are introduced.



Black walnut mortality caused by the walnut twig beetle and fungus complex in Boulder.



Russian-olive, shown on the left side of photo, and tamarisk, shown on right, have infested the Purgatoire River near Trinidad, Colo.



Riparian Forests

The contributions of Colorado's riparian forests, which grow along rivers, streams, and creeks, sometimes are overlooked. These forests consist primarily of cottonwood, willow, and shrub species.

Colorado has 232,000 acres of riparian forests. Although this represents only about 1 percent of the state's total forested area, these areas provide essential benefits disproportionate to their size. Benefits include maintaining water quality and quantity, recharging ground water, and reducing erosion. Native trees and shrubs along waterways help filter water, prevent flooding, remove excess nutrients, and provide excellent wildlife habitat.

Active management is occurring on the Eastern Plains and throughout Colorado to protect riparian forests. One example is an effort to reduce tamarisk, also known as salt cedar. Tamarisk is a small non-native tree/shrub that has invaded Colorado's waterways. Tamarisk's extensive root system, which can reach a depth of 100 feet, uses available water and its leaves deposit a salt residue on the soil's surface. Because native species cannot survive when high salt levels are present, tamarisk out-competes and quickly replaces native cottonwoods, willows, grasses, and forbs. Salt cedar and other invasive trees such as Russian-olive compromise the livelihood of Colorado's agricultural community by consuming valuable water required for farming and ranching.





According to the Tamarisk Coalition, more than 50,000 acres of tamarisk infest the Colorado, Arkansas, and Purgatoire rivers and their tributaries. The Coalition estimates that tamarisk consumes approximately 75,000 acre feet of water annually in these rivers and tributaries. This is above and beyond what native vegetation would use. Seventy-five thousand acre feet of water can supply enough potable water to support 187,000 households every year. Tamarisk has taken hold in additional waterways in the state, but infestations have not yet been quantified.

Several projects already are underway to control Colorado's significant tamarisk problem, and continued perseverance can help ensure success. Informational websites, such as www.tamariskcoalition.org, also are an effective tool in the effort to protect and restore the state's riparian forests.

From waterways to mountains and cities, Colorado's forests provide invaluable benefits to the state's residents. However, human interference with natural processes, such as spreading invasive species and interfering with fire's natural role, has compromised the state's forests. Working to remedy the troubles incurred by humankind's actions in forested systems is both responsible and prudent. Often this is best accomplished by mimicking nature and replacing invasive species with native vegetation.

Salt Cedar: Drinking Colorado's Waterways Dry



Members of Volunteers for Outdoor Colorado apply herbicide on recently cut salt cedar at the Boggsville Historic Site on the Purgatoire River near Las Animas, Colo. If a herbicide is not applied after treecutting, the invasive tree would resprout and continue to consume vast amounts of water and deposit salt in the soil. The final stages of this project involve planting, monitoring, and maintaining native species.

Forest Challenges: Today and Tomorrow

"Climate change is our generation's greatest environmental challenge."

– Gov. Bill Ritter

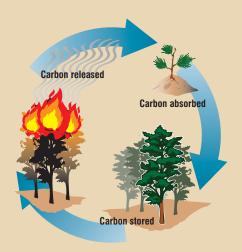
In addition to specific current conditions, broader challenges likely will affect Colorado's forests over the next 10-15 years. Climate change, forest fragmentation, and fire suppression are three prominent issues that will continue to disrupt the state's forests in many ways. Warmer temperatures already have lengthened fire seasons in the West and extended the range of the mountain pine beetle. Ever-increasing human use of the forest has resulted in forest fragmentation and increased firefighting costs. And the struggle to balance the ecological value of fire with the need to protect homes and communities continues to make fire suppression a critical management issue. If left unaddressed, these challenges will affect Coloradans' health and safety through wildfire and water supply issues.

Climate Change

Climate is the variability of temperature and precipitation over a period of time for a particular area. Climate change, including warming temperatures and altered precipitation, can result from increased greenhouse gases such as carbon dioxide. The largest sources of carbon emissions in the United States are power generation and vehicle emissions.

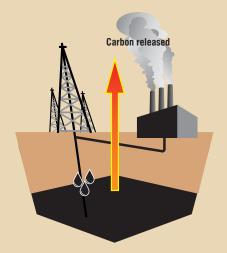
According to Colorado State University researchers, the most important variable in determining forests' total carbon loss is the pre-fire landscape carbon content. This is related to past forest management and disturbance history, as well as fire behavior. When drought and high-intensity fires occur, total regional carbon losses from forest fires in the western U.S. represent significant amounts of released carbon.

The Natural Carbon Cycle vs. Carbon Released from Fossil Fuels



The Natural Carbon Cycle

The natural carbon cycle between vegetation and the atmosphere does not add new carbon over time. Even when wildfires "produce" a large amount of atmospheric carbon, this carbon is then used by rapidly growing seedlings.



One-Way Carbon Release

Using underground fossil fuels releases carbon that was sequestered, or fixed, eons ago. Once fossil fuels are burned, most of the resulting carbon remains in the atmosphere. A very small percentage is absorbed by oceans over hundreds of years.





Impacts on Colorado's Forests

Colorado's forests likely will experience increased wildfire seasons, exacerbated insect outbreaks, and reduced snow quality for skiing and other winter sports in the coming decades. Although climate models lack consensus regarding the amount of precipitation, most project that precipitation will become more erratic, with dry periods, as well as more intense rain and snow events.

A U.S. Forest Service report estimates that a temperature increase of 6.3° F in the Rocky Mountains will shift suitable growing environment for forest vegetation types approximately 2,000 feet upslope or 200 miles further north. Foresters are unsure what this may mean for Colorado's iconic aspen forests growing on the state's western mesas, because the land elevation is low, which precludes aspen migration.

Wildfire

Wildfire is part of Colorado's natural forest system. However, it can pose major threats to people, homes, businesses, local economies, and drinking water supplies.

In the West, longer wildfire seasons, extreme wildfire conditions, rising numbers of large and severe wildfires, and increasing burned areas already occur. This strongly correlates with warming and drying trends, and likely will worsen as temperatures continue to rise. Additionally, because historical fire regimes have been disrupted, many of Colorado's forests are even more susceptible to climate change effects.

Increased wildfire severity and precipitation falling on burned areas is likely to have detrimental effects on the state's water supply.

Is Climate Change Real?

"Warming of the climate system is now unequivocal," said Dr. Susan Solomon. at the release of the report by the Intergovernmental Panel on Climate Change in February 2007. She presented findings from "The Physical Science Basis," produced by 600 scientists from 40 countries. In addition to co-chairing the IPCC Working Group I, Solomon is a Senior Scientist at the National Oceanic and Atmospheric Administration in Colorado.

The IPCC and Former Vice President Al Gore were awarded the Nobel Peace Prize in October 2007 for their climate change research and outreach efforts.

Gradual temperature and drought increases can result in abrupt changes in wildfires. In 2007, Colorado had a less-than-average fire season in terms of acres burned, but other western states such as Idaho and Utah had recordbreaking seasons. Even veteran firefighters witnessed phenomenal fire behavior they had not previously seen. Already, extreme fire conditions in the West have made traditional firefighting techniques less effective. Under future drought and hightemperature scenarios, fire suppression tactics likely will need to be changed.



Forest fragmentation is the breaking up and loss of continuous forest land to other uses such as building lots and roads.

Forest Insects

In Colorado, nearby states, and Canada, warmer winters and drought have allowed insects such as mountain pine beetles to proliferate at alarming rates and move further north and higher in elevation than previously seen. In areas of southwest Colorado, bark beetles in piñon pine caused 90 percent die-off a few years ago. In both cases, winters have been too warm to inhibit the growing bark beetle populations.

Implications of Climate Change on Colorado's Forests

Although many projects aimed at protecting Colorado's communities and natural resources from wildfire currently are underway, the problem is immense.

Increasing fuels reduction projects is imperative in order to protect communities and critical watersheds. These efforts should include strategic information and education campaigns that foster action among all stakeholders.

Forest Fragmentation and Development

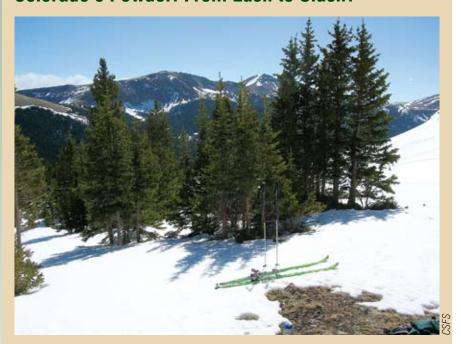
Colorado currently has 4.3 million residents and, according to the U.S. Census Bureau, was the eighth-fastest growing state in the U.S. in 2006. Growing populations can put pressure on forests and jeopardize the benefits that forests provide. Sound forest management and proactive planning for growth can help mitigate the negative impacts of human use on our forests.

Residential Development

Forested watersheds provide highquality water that is used by residents, farmers, and ski areas. Loss of protective forest cover due to development can increase runoff following storms, increase soil erosion, reduce groundwater infiltration, and increase sedimentation in streams. Such damage degrades water quality and fish habitat.

Residential development causes fragmentation, or parcelization, of large, contiguous forest areas into smaller, disconnected tracts. It also results in an increase in the number of individual owners. When residential development occurs on forest lands, it not only reduces the amount of forest cover, it also increases demand for and costs of wildfire protection; fractures wildlife travel corridors and habitats; and produces a corresponding increase in per-acre forest management expense and complexity.

Colorado's Powder: From Lush to Slush?



With warming temperatures, the quality of snow is expected to change from dry, lush powder to wetter, heavy slush.



The Wildland-Urban Interface

When residential development occurs on the forest fringe or other fire-prone areas, it is known as the wildland-urban interface (WUI). These dangerous residential fire zones put firefighters more at-risk. Even experienced and highly qualified firefighters have been killed or had near misses while fighting fires in the wildland-urban interface.

The WUI involves areas of mixed ownerships and multiple jurisdictions, resulting in an array of political, social, and economic challenges. Dispersed homes are harder to defend from wildfire, especially when the homes do not have a defensible space.

Defensible space is a buffer zone of reduced vegetation around a home that reduces fire hazards and gives firefighters space to do their jobs.

Protecting the wildland-urban interface is the nation's fastest-growing firefighting expense. Currently, suppressing wildfires in the WUI accounts for 85 percent of firefighting costs in the United States. Protecting life and property in these areas is expensive because fire managers must take aggressive stands on the ground and from the air.

As more people own land and live in forested areas, it becomes more difficult and expensive to treat that area and keep it healthy. Researchers from the Pacific Northwest found that mechanical fuels reduction treatments were three to four times as expensive if they occurred in the wildland-urban interface. And it is harder to gain consensus about forest management actions among multiple landowners. Prescribed fire, in particular, can be a painstaking endeavor in developed



landscapes because of the extremely high complexity involved in burning near homes. The high levels of communication required between landowners and firefighters also is challenging.

Rural Sprawl

A 1972 Colorado law exempts developers from county subdivision requirements if the parcels they're selling are 35 acres or larger, thus the 35-acre ranchette was born. However, these lower densities are more difficult to protect from wildfire. They also require the installation and maintenance of more roads and necessitate more driving to and from communities where services are offered.

Low-density development takes more land to house fewer people, greatly increases traffic and pollution from additional driving, and impacts wildlife. In addition to fragmenting wildlife habitat and travel corridors, increased rural development threatens and endangers wildlife species. Subdividing large ranches into ranchettes is a growing trend throughout Colorado.

In addition to increasing the demand for wildfire protection, development in fire-prone areas also requires more roads and services. This adds to the financial burden of all Colorado taxpayers.

More than half of new rural housing in Colorado is in the wildland/urban interface.





GIS in Land Use Planning

By overlaying the effects of human activity on the landscape, a geographic information system (GIS) shows how these activities altered the land over time. For example, the wildland-urban interface has grown by more than 50 percent since 1970 and has increased human activity in wildfire-prone areas.

GIS can be an invaluable tool in planning developments that minimize the human imprint on the landscape. Ouray County officials are considering a GIS analysis that shows different land use plans. Dispersing homes on larger lots significantly reduced wildlife habitat and agricultural land, and increased the number of miles driven by up to five times. More clustered housing had far fewer impacts.

A Colorado State
University analysis
(D. Theobald and
W. Romme, 2007)
projects that the
state's wildland-urban
interface areas will
increase from 715,500
acres in 2000 to
2,161,400 acres in 2030,
a 300 percent increase.

In recent years, state and local efforts have prevented hundreds of thousands of acres from being developed. However, Colorado's open spaces are disappearing at three times the rate of the national average. A Colorado State University study projects that wildland-urban interface areas will double in the state over the next two decades.

Implications of Forest Fragmentation and Development on Colorado's Forests

Apart from the tangible effects of wildlife habitat loss, impaired water quality, and reduced timber production, loss of forested landscapes has other social consequences for our increasingly urbanized population. As more forest land is permanently converted to non-forest land uses, fewer Coloradans will be able to enjoy the natural beauty of our forest landscapes and experience the personal renewal gained by spending leisure time there.

Growth in Colorado is a fact of life. How that growth is planned, however, should be evaluated for the long-term. The cumulative effects of pollution from increased driving and forest fragmentation may adversely affect current and future generations of Coloradans.

Fire Suppression

Colorado has two major fire suppression issues. The first is the legacy of unnatural, dense forests in some areas because of past fire suppression. The second is the need to protect lives, property, and vulnerable resources from fires that occur as a result of accumulated fuel build-ups. Balancing ecologically beneficial wildfires with community protection is imperative.

A century of fire suppression, often without additional management to replace the beneficial effects of fire, has allowed a build-up of fuels that threaten communities and economies when wildfires occur. Additionally, fire suppression has resulted in age homogeneity in high country forests, creating continuous, older forests that sustain beetle populations. Intense wildfires that burn in built-up, continuous fuels can cause extensive damage to property and water supply systems.

Compounded with climate change, the state's forests are almost certain to experience increased wildfires and wildfire effects, with more severe impacts on landscapes.

Colorado's history of land development and fire suppression has led to an increase in the cost and complexity of wildfire suppression. This seemingly self-perpetuating cycle of fuel build-ups,



greater wildfire risk, and higher stakes can be broken. Proactive tools such as forest thinning and fuels reduction can help move Colorado toward healthier forests, safer citizens, and more effective protection of natural resources.

In 2007, Colorado's wet spring, prepared firefighters, and early engagement of single engine air tankers helped keep fires small. However, another big fire season is certain to occur in Colorado. Less active fire seasons today lead to greater fire potential tomorrow. Without wildfire mitigation, fuel

loads increase every year. When fires burn in areas of built-up fuels, they can threaten communities, water supplies, forests, and other natural resources.

Fire suppression is necessary to protect life and property. However, not all fires should be suppressed. This only leads to larger fires in the future. It also prevents fire from playing a role in maintaining ecosystems in which fuel accumulations have not yet reached unsafe levels. See Appropriate Management Response on page 27 for more information.

Wildland-Urban Interface: Burning up the Budget?

While increasing numbers of homes in the wildland-urban interface raise firefighting costs, paying for firefighting is a national burden. As decisions are being discussed in Washington about how to deal with this growing issue, many have suggested that local jurisdictions should assume more of the costs for fighting wildfires.

Nationwide, almost half of the U.S. Forest Service budget is spent on fire suppression. This leaves little funding to provide for the stewardship of our nation's forests, which benefit all Americans, whether rural or urban. They are places where watersheds can be protected and enhanced to provide clean water, improve air quality, and contribute to carbon sequestration. However, when funds intended for forest stewardship are used for fire suppression, National Forests can grow unhealthy, and they can become liabilities instead of assets.



A single-engine air tanker fights a wildfire near the Cameo exit of Interstate 70 in western Colorado in the summer of 2007.

Today's Solutions for Tomorrow's Forests

"One of the best ways to address climate change is to use more wood, not less. Every wood substitute, including steel, plastic and cement, requires far more energy to produce than lumber."

Patrick Moore, former
 Director of Greenpeace
 International

Natural resources are among Colorado's most valuable assets and are worthy of protection and stewardship. Breaking down seemingly insurmountable challenges into achievable pieces requires coordination and cooperation among all stakeholders. Addressing these challenges will require land managers and other stakeholders to work at landscape and local scales.

Although it may seem counter-intuitive to cut trees to promote forest health, when properly done, mimicking nature through well-planned disturbance truly benefits forests. This, then, helps maintain the benefits forests provide over time. Because wood is a renewable resource, using wood in place of petroleum and other non-renewable carbon sources has a beneficial environmental impact. Additionally, healthy forests are more efficient at sequestering carbon than unhealthy forests, and will benefit the global climate.

Forests Countering Global Warming

People can use forests to address climate change by:

- Using sustainably managed wood products in construction
- Using forest biomass in bioheating
- Strategically placing trees around homes and urban communities to reduce energy use

A substantial amount of carbon remains stored in forest products that are harvested and manufactured for use in construction, furniture, and other wood products. This carbon does not contribute to climate change until the wood either decomposes or is burned.

Forests have a role in combating climate change. Using biomass from forests as a means of heating can reduce the use of fossil fuels that contributes to excess carbon dioxide.

Carbon Released Carbon Released Carbon Stored Carbon Stored







Young, growing forests take up more carbon than old, less vigorous forests.

Urban forests also are part of the solution to global warming. According to an American Forests report, the direct shade that trees provide to residential homes in Colorado's northern Front Range metro area saves \$3.5 million annually.

Industry Infrastructure

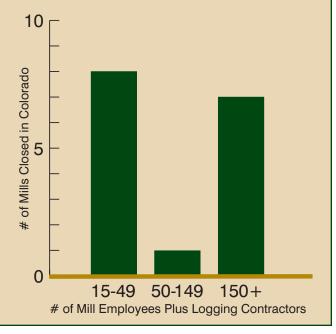
Colorado has never had a large forest industry. The state's modest-growing timber is not like that of the Pacific Northwest or the hardwoods in the East. In the late 1800s and early 1900s, trees were cut for mining props and railroad ties. Later, local wood was used for 2x4s and other building materials. Currently, however, only about 5 percent of Colorado's annual net forest growth is harvested. So every year, the state's forests are becoming more overcrowded.

Significant energy expenditures, primarily in the form of fossil fuels, are involved in importing nearly all of Colorado's wood from out of state or out of the country. Therefore, producing more wood in Colorado for local use would help reduce greenhouse gas emissions, provide opportunities for the development of small businesses, and promote effective forest management.

According to the
Colorado Forestry
Association, forest
inventory of saw timber
more than tripled in
Colorado's National
forests from 1909 to
1997.

Colorado Lumber Mills Closed Since 1980

Since 1980, 16 of Colorado's medium- to large-sized lumber mills closed. Today, 22 mills remain in the state that employ more than 15 people, including logging contractors. Of these, only five employ more than 50 people.





"It's just a tragedy to have to pay \$3 for a doggone 2x4 when millions of board feet of material are lost to fires and disease and waste every single year."

> Granby resident in the "Colorado Community Response to Bark Beetles" survey conducted by the University of Illinois.

Woody biomass heats the Boulder County Open Space facilities in Longmont. More than 60 percent of residents who responded to a survey taken in Eagle, Summit, Grand, Jackson, and Routt counties support small-scale timber processing and niche marketing. Approximately 30 percent support large-scale timber processing.

Although sustainable harvesting is a good way to regenerate forests and add diversity to the landscape, forest harvesting has decreased since the 1970s. Today, at least 90 percent of all wood products used in Colorado are imported from other states or foreign countries.

In addition to the lack of social acceptance, funding shortfalls constrain successful implementation of high-priority management objectives in Colorado's forests. Without adequate wood-processing facilities, it is not cost-effective to remove trees.



Woody Biomass

The Front Range Fuels Treatment
Partnership Roundtable identified
1.5 million acres that require treatment on
the Front Range to protect communities
and restore forest health. Approximately
\$15 million per year would be required
to meet this objective on both federal and
non-federal land over a 40-year period, far
more than the \$6 million per year that has
been available.

One way to reduce the cost of land treatments is to find an economically viable use for the materials removed. The utilization of woody biomass for bioheating is a particularly promising solution to address the fuels build-up in Colorado's Front Range forests. Branches, small trees, and other woody debris can be burned in wood-fired boilers to produce heat for schools, libraries, government offices, and other local facilities. This practice can reduce forest treatment costs by up to 40 percent and provide a unique way to connect local communities with natural resources. The Colorado State Forest Service, in collaboration with the Colorado Wood Utilization and Marketing Program at Colorado State University, is working with communities to identify and pursue local opportunities for putting woody biomass to use.

These are just some of the beneficial solutions that have been identified to address the critical issues related to declining forest health and increasing wildfire risk in Colorado. Additional solutions are likely to evolve, and steps can be refined as new wood utilization technologies emerge and outreach efforts spur action. Moving people from awareness to action is critical to the success of long-term forest stewardship.





On-the-Ground Successes

Although it can be challenging, collaboration is valuable, especially in areas where people have demonstrated a strong interest in working together across boundaries to address forest health and/or fire issues. Many consider collaboration vital to creating diverse, healthy forests over time.

Reducing Hazardous Fuels on Colorado's Front Range

The Front Range Fuels Treatment Partnership (FRFTP) was formed after the disastrous fire season of 2002, the worst in Colorado's recorded history. The FRFTP is a dynamic partnership comprised of federal, state, and local governments, land-management agencies, private landowners, conservation organizations, and other stakeholders. The purpose of the Partnership is to reduce wildland fire risks through sustained fuels treatment along Colorado's Front Range to enhance community sustainability and restore fireadapted ecosystems over a 10-year period.

To identify large areas where treatment needs are of greatest concern, Partnership agencies conducted a large-scale rapid assessment of hazardous fuel conditions along the Front Range based on areas of low to very high hazard, risk, and values. The assessments indicate that approximately 510,000 acres are high priority for treatment; 440,000 acres on National forests, and 70,000 acres on private land.

From 2003-2006, Partnership agencies treated a total of 86,515 acres, primarily within the wildland-urban interface.

Treatment decisions were based on county fire plans, Community Wildfire Protection Plans, and other critical planning documents that identified areas with very high hazard, risk, and values.



The Partnership has received national attention as a model for successful collaboration that results in on-the-ground accomplishments.

The Partnership continues to treat high-priority areas with funding received primarily through competitive grants.

The Firewise Council of Southwest Colorado

Forest landowners and forested communities must assume responsibility for stewardship and fire mitigation on their properties and in their neighborhoods.

However, many residents don't believe that they will be affected by fire. Social research revealed that effective communication Members of a State Wildfire Inmate Team establish a permanent fireline on Denver Water land near Deckers for future prescribed fire projects. The project was done under the auspices of the Front Range Fuels Treatment Partnership.







The Colorado State Forest Service reduces hazardous fuels on state land in northern Colorado through prescribed fire.

often is the missing link in prompting landowners to take action to mitigate fire hazards. Different methods of community outreach, including word of mouth, are vital to fostering community interest in wildfire hazard mitigation. One successful effort that incorporates these tools is the Firewise Council of Southwest Colorado.

The Firewise Council of Southwest Colorado is a collaborative community effort whose purpose is to mitigate the threat of wildfire to homes, lives, and property. Since its inception in 2003, this grassroots regional initiative has been creating safer communities in La Plata, Montezuma, and Archuleta counties by placing particular emphasis on educational outreach and advocacy, and influencing on-the-ground wildfire mitigation projects. The Council is housed by the San Juan Mountain Association, a non-profit organization, and funded by grants, donations, and volunteer support.

Interested citizens are encouraged to participate in this community initiative comprised of fire departments and districts, the Colorado State Forest Service, the San

Juan Public Lands Center (U.S. Forest Service and Bureau of Land Management), the Office of Community Services at Fort Lewis College, private landowners, homeowners associations, businesses, nonprofit organizations, and other interested stakeholders.

The Neighborhood Ambassador program is the Council's key mechanism for information dissemination. The program began in December 2004 to teach local citizens about wildfire issues. Those who receive training share information with their neighbors about emergency preparedness, defensible space, and the importance of wildfire mitigation. The 54 ambassadors currently active in the three counties volunteered more than 2,500 hours in 2007, delivering information about wildfire mitigation to more than 400 residents. As a result of their efforts, more than 85 landowners have done mitigation work on their properties and seven neighborhoods are developing Community Wildfire Protection Plans.

Community Wildfire Protection Plans

Local wildfire protection plans can take a variety of forms, based on the needs of the people involved in their development. A Community Wildfire Protection Plan (CWPP) may address issues such as wildfire response, hazard mitigation, community preparedness, and structure protection.

The process of developing a CWPP can help a community clarify and refine its priorities for the protection of life, property, and critical infrastructure in the wildland-urban interface. It also can lead community members through valuable discussions regarding management options and implications for surrounding watersheds.

As of Nov. 30, 2007, 76 CWPPs were completed in Colorado, and an additional 33 plans were being developed. Most CWPPs cover multiple communities.





2007 Forestry Legislation

In 2007, the Colorado State Legislature passed three important forestry-related bills and a resolution in the first session of the 66th General Assembly. The bills encourage local leaders to use various tools to develop solutions that address forest health issues in their communities.

PROVIDING STATE LEADERSHIP House Bill 07-1130, Community-Based Forest Restoration

Rep. Dan Gibbs / Sen. Joan Fitz-Gerald

This legislation authorizes the use of up to \$1 million per year over 5 years for a cost-share grant program aimed at community-based forest restoration projects in Colorado. These projects protect critical water supplies and address related forest health challenges in Colorado. The state's contribution to any one project may not exceed 60 percent of the total project cost. Gov. Ritter signed the bill in May 2007.

The \$1 million in grant funding, which was provided by the Colorado Water Conservation Board, will allow the 12 grant recipients to treat 13,420 high-priority acres

to help protect watersheds, communities, and other critical infrastructure throughout Colorado. In addition, grant funds are leveraging more than \$2.8 million of additional cash and in-kind match.

A technical advisory panel evaluated 46 grant applications and recommended projects for funding. The panel was comprised of representatives from the Colorado Department of Natural Resources, U.S. Forest Service, Bureau of Land Management, Colorado State University, Wilderness Society, Rocky Mountain Research Station, a town mayor, and the Colorado Timber Industry Association.

LOCAL OPPORTUNITIES House Bill 07-1168, Forest Improvement Districts

Rep. Al White / Sen. Joan Fitz-Gerald

This bill authorizes a municipality or county to propose to its voters the formation of a Forest Improvement District through which the municipality or county could tax itself to raise money for priority forest improvement projects. With this bill,



In 2007, the Coalition for the Upper South Platte, in cooperation with Teller County, operated a slash drop-off site in Divide, Colo., with grant funding provided by HB-1130. Without sites that take tree branches and other wood waste, hazardous fuels reduction projects can be even more costly and difficult.





Forest landowners participate in a FireWise workshop in Teller County to learn what they can do to help protect their communities from wildfire and improve the health of their forest lands.

local communities have an opportunity to address forest health issues while maintaining local control. A local board of directors would be created to manage Forest Improvement District projects, and to oversee and administer funds created by the District.

Forest Improvement District revenues could be used for such purposes as implementing a hazardous fuels project to protect a community. Revenues also could be used to establish financial incentives for landowners to mitigate wildfire risks on their properties, develop Community Wildfire Protection Plans, engage in community outreach efforts, or match funds for grants related to bioheating.

RENEWABLE ENERGY

House Bill 07-1145, Renewable Energy on State Lands

Rep. Michael Merrifield / Sen. Ken Gordon

Directors of the State Board of Land Commissioners will survey their lands to determine the potential to develop renewable energy and are authorized to lease such lands for renewable energy development. Renewable energy includes biomass, which is defined as "nontoxic plant matter consisting of agricultural crops or their byproducts, urban wood waste, mill residue, slash, or brush."

ENCOURAGING FEDERAL INITIATIVE

Senate Joint Resolution 07-006, Stewardship Contracting in Colorado

Sen. Joan Fitz-Gerald / Rep. Dan Gibbs

This resolution urged the federal government to be proactive in addressing forest health conditions on public lands in Colorado. Upon its passage in February 2007, SJR 07-006 was sent to Colorado Gov. Bill Ritter and Mark Rey, United States Department of Agriculture Undersecretary for Natural Resources and the Environment, to send a clear message that decision-makers want increased forest management on federal lands in Colorado.

In the bill, the Colorado General Assembly urged the U.S. Forest Service and the Bureau of Land Management to collaborate with the Colorado State Forest Service and other stakeholders to implement up to three long-term stewardship contracts on public lands in the State of Colorado. Stewardship contracts are 10-year contracts designed to accomplish forestry work that allows contractors the opportunity to trade goods such as firewood or logs for services such as forest restoration and/or wildfire risk reduction efforts. Stewardship contracts can help accomplish much needed forestry work despite the state's low-value timber and wood products, and a lack of locally based forest-products industries.





Actions and Strategies for Healthy Future Forests

Following are a range of ideas that could help Colorado's forests and the people who depend on them.

- Remove excess fuels, reduce tree densities in uncharacteristically crowded forests, and use prescribed fire to promote the growth of native plants and reestablish desirable vegetation and fuel conditions.
- Strategically place burning and fuels reduction treatments on the landscape where they are more likely to reduce fire spread toward communities and sensitive watersheds.
- Increase outreach efforts regarding the carbon footprint of locally produced wood versus imported wood.
- Thin and create some openings in areas where fire historically burned more frequently.
- Patch or clear cut areas where fire burned less frequently but more intensely (high country) to create openings.
- Remove dead and dying trees to allow for the growth of the next forest and reduce the fuels available for fire.
- Introduce cutting and/or fire into old aspen stands to mimic natural disturbance.
- Introduce prescribed burning in some beetle-kill areas to protect communities, hasten regrowth, and help protect watersheds.
- Increase support for the development and implementation of Community Wildfire Protection Plans.
- Increase subsidies and incentives for local wood production and utilization. Government subsidies can stimulate economies and benefit Coloradans.
- Provide additional financial and technical support for ongoing



ecological restoration programs around the state, especially those where past fire suppression has created unnatural stand structures and fire hazards.

• Implement regulations to establish and maintain specific forest densities and fuel loads on forested urban-interface property.

Appropriate Management Response to Wildfires

Appropriate Management Response is a way of responding to wildfires and is an important element in strategic forest management involving an evaluation of current and likely conditions and a response tailored to those conditions. Rather than moving immediately to a full-scale, full-suppression approach, Appropriate Management Response can employ less aggressive control actions. It also can allow fires to provide ecological benefit where fires are not immediately threatening resources.

While implementing an Appropriate Management Response, the full spectrum of tactical options, from monitoring a fire at a distance to intensive suppression actions, are available. During the initial response to any wildland fire, firefighters will manage the fire to achieve the most effective, efficient, and safest possible outcome.

Point protection, shown above in the 2002
Big Fish Fire Use Fire outside Meeker, Colo., is increasingly undertaken in Appropriate Management Response fires. Sprinklers and protective wrapping are examples of point protection.

Conclusion

Public and private forests provide diverse benefits such as clean water, wildlife habitat, wood products, recreation opportunities, range for livestock, and wilderness areas. Increasingly, these forests need to be managed to address contemporary and emerging issues including forest health, wildfire, carbon sequestration, potential climate change, and biomass energy. Management also must ensure the continuance of the broad array of ecosystem services upon which the public's welfare depends. These goals cannot be attained by a hands-off, leave-it-

to-nature approach. They require careful planning, collaboration, and action.

Although the challenges Colorado's forests face may be daunting, they are not insurmountable. They do, however, require consensus and political resolve to fix. Ensuring the continuation of the benefits that our forests provide, and that Coloradans depend on, is critical to Colorado's future. The forests that our children and grandchildren inherit will be shaped by the decisions we make and the actions we take today.

Fall colors comprised of beetle-killed lodgepole pines and aspen trees paint the landscape on Berthoud Pass.



References and Further Reading

- American Forests, April 2001. Regional Ecosystem Analysis for Metropolitan Denver and Cities of the Northern Front Range, Colorado. 12 pp.
- Aspen Global Change Institute, 2006. Climate Change and Aspen: An Assessment of Impacts and Potential Responses
- Association for Fire Ecology, November 2006. The San Diego Declaration on Climate Change and Fire Management. 5 pp.
- Berry, A.H., Hesseln, H., 2004. The effect of the wildland-urban interface on prescribed burning costs in the Pacific northwestern United States. Journal of Forestry, Pages 33–37.
- Brown, James K and Jane Kapler Smith, editors. 2000. Wildland Fire in Ecosystems Effects of Fire on Flora. General Technical Report RMRS-GTR-42-volume 2. U.S.D.A. Forest Service, Rocky Mountain Research Station. Ogden, Utah. 257 pp.
- Colorado Department of Natural Resources, January 2004. 10-Year Strategic Plan on the Comprehensive Removal of Tamarisk and the Coordinated Restoration of Colorado's Native Riparian Ecosystems. 87 pp.
- Colorado Forestry Association, 2007. Forestry Journal. Volume 26, Issue 24. 12 pages.
- Colorado Ski Country USA, March 2004, Economic Impact Study.
- IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment. Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.
- IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L.

- Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Le Master, Dennis C., Guofan Shao and Jacob Donnay, 2007. Protecting Front Range Forest Watersheds from High-Severity Wildfires. The Pinchot Institute for Conservation. 47 pages.
- Omi, Phil N, 2005. Forest Fires: A Reference Handbook. ABC-CLIO. Santa Barbara, CA. Pp. 174-175.
- Rehfeldt, Gerald L, 2006. A spline model of climate for the Western United States. Gen. Tech.
- Rep. RMRS-GTR-165. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky
- Mountain Research Station. 21 p.
- Rehfeldt, Gerald E.; Crookston, Nicholas L.; Warwell, Marcus V.; Evans, Jeffrey S, 2006. Empirical Analyses of Plant-Climate Relationships for the Western United States International Journal of Plant Sciences (167) 6:1123-1150.
- Society of American Foresters, 2004. Loss of Forest Land. A Position Statement. 7 pp.
- Society of American Foresters, 2004. Wildfire Protection: Community Wildfire Protection Plans from Four Angles. Journal of Forestry 102(6): 4-7.
- Tamarisk Coalition, 2006. Tamarisk Inventory for the Colorado, Arkansas, and Purgatoire Rivers, Summary. 3 pp.
- Theobald, David M. and William H Romme, December 2007, Expansion of the US Wildland-Urban Interface. Landscape and Urban Planning, Volume 83, Issue 4, Pages 340-354
- Westerling. A.L., H. G. Hidalgo, D. R. Cayan, T. W. Swetnam, 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. Science. 313(5789): 940 943.

Reference Website

www.tamariskcoalition.org

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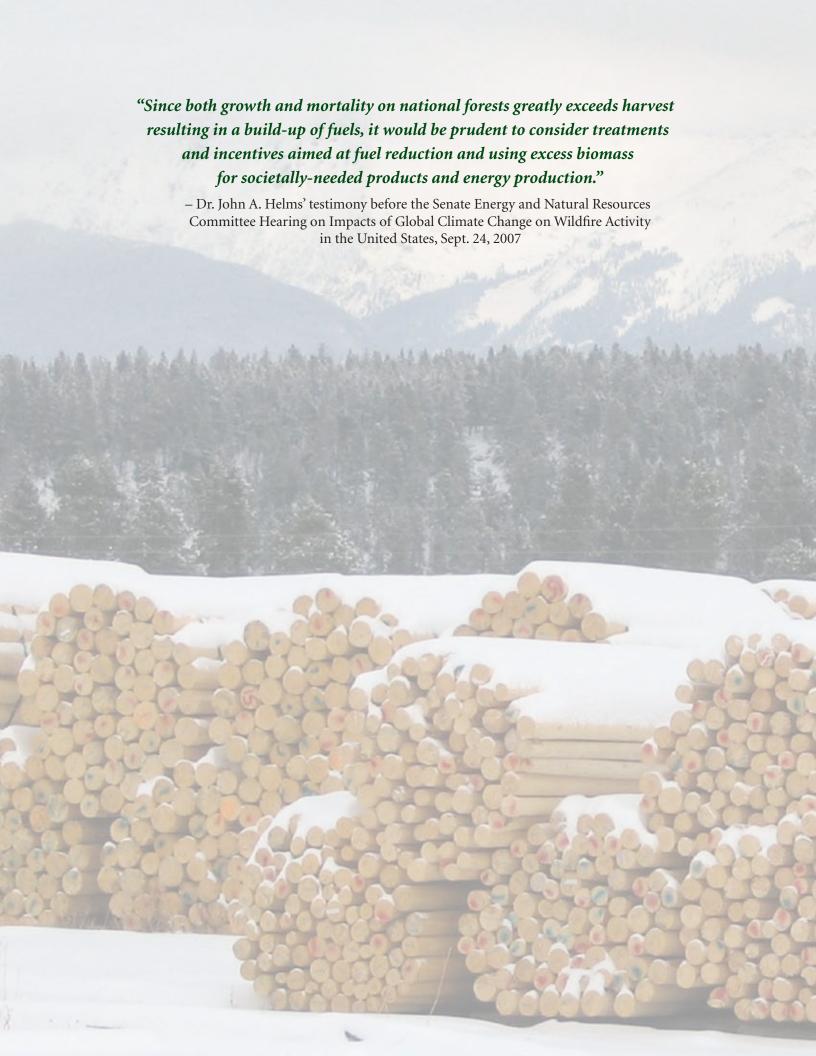
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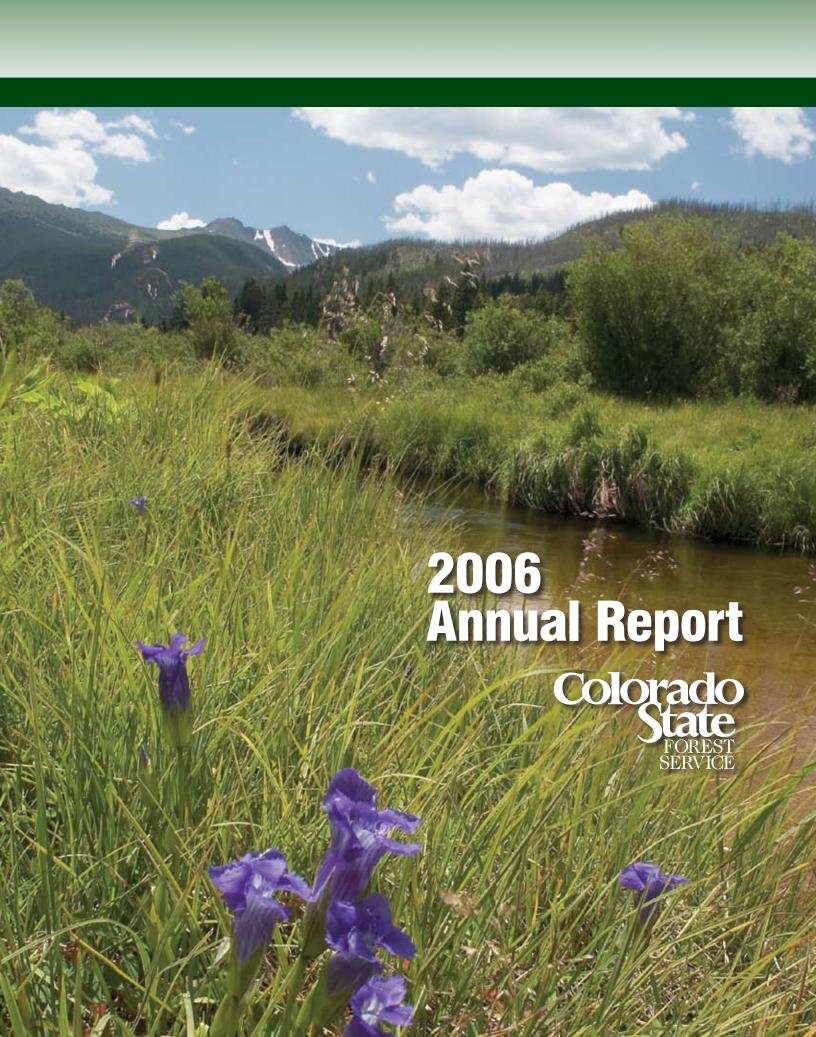
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Photographs: *Front cover*, Bill Cotton (upper) and Jen Chase (lower). *Banner*, Jen Chase. *Inside back cover*, Ron Cousineau.









Reflections on 2006

This document is a celebration of the successes of the Colorado State Forest Service (CSFS) over the past year. Our organization continues to evolve steadily in a direction that will achieve our strategic priorities. The evolution is occurring on many levels, including:



Jeff Jahnke, Director

- In 2006, wildfire
- preparedness received significant support from the Colorado Legislature. A Wildfire Preparedness Fund was created, and \$3.25 million appropriated per year for the next five years, to implement annual Wildfire Preparedness Plans. This legislation will significantly increase our effectiveness in protecting lives and property throughout Colorado.
- CSFS was challenged in 2005, both internally and externally, in bringing the Community Wildfire Protection Plan (CWPP) concept to fruition. However, 2006 saw a groundswell of activity throughout the state. Communities and individuals are grasping the importance of planning and the effectiveness of this tool in protecting communities from wildfire. As with the adoption of any new idea, this one took time but 2006 results were extremely encouraging.
- CSFS also is undergoing an evolution from a traditional model of forestry serving the public one-on-one as technical advisors to being a leader in maintaining Colorado's forests. No longer can we merely disseminate information; we must ask the question, "What should be happening to improve the conditions of Colorado's forests?" As a result, we are emphasizing more collaborative efforts with our partners, other agencies, researchers, and individuals. These relationships serve to promote, focus, and interpret ongoing research to apply to ground-level forestry activities.

- Participation in forestry issues by those who have not traditionally come to the table is increasingly common, as exemplified in recent years by the Front Range Fuels Treatment Partnership Roundtable, the Northern Colorado Bark Beetle Cooperative, and multiple ongoing collaborations across the state in community wildfire protection planning. Citizens are recognizing their rights and responsibilities toward improved forest health and adequate wildfire protection and are adding their voices to the decision-making process.
- The CSFS evolution also involves an increasing number of younger foresters as a major force in CSFS. This cadre is one of our greatest strengths and well worth celebrating. They are emerging from academic instruction with a broader, overall focus on forestry issues. This is a significant change from an earlier model of "getting out in the woods and marking trees" (although, of course, foresters still love to do that). They are joining us with the skills necessary for 21st century forestry and are motivated by a new way of working toward achieving healthy forest conditions.
- One of our greatest successes last year was the institution of the area forester concept. As a result of examining the CSFS structure and identifying both forestry and personnel needs, CSFS functionally divided the state into northern and southern regions. We have found this new approach to be a huge success organizationally.

Evolution is a dynamic process, as are forested ecosystems. CSFS will continue to evolve to address forest health and fire protection effectively in Colorado, and we, too, will remain dynamic. This is the core of our strength and also of our success.

The successes of 2006 are due to the contributions of each of our dedicated employees and the support of our invaluable partners. We thank you very much and look forward to 2007.

HH JUL

Strategic Priority: Fire preparedness and response

Provide leadership in wildland fire protection for state and private lands in Colorado and reduce wildfire-related loss of life, property, and critical resources.

Wildfire Preparedness Receives Support from the Colorado Legislature

Wildfire preparedness received significant support from the 2006 session of the Colorado Legislature. Introduced as Senate Bill 096 (SB 96) by Senator Jack Taylor, with wide support in the House and Senate, the General Assembly directed the creation of a Wildfire Preparedness Fund in the State Treasury and also appropriated \$3.25 million per year for the next five years to implement annual Wildfire Preparedness Plans.

An annual Wildfire Preparedness Plan is developed by a collaborative group comprising the state forester, a representative of the County Sheriffs of Colorado, a representative of the Colorado State Fire Chiefs' Association, the director of the Division of Emergency Management, and the adjutant general or his or her designee. The Colorado State Forest Service implements the plan, drawing on the Wildfire Preparedness Fund.

Prior to SB 96, funding for the availability of state preparedness resources was not specifically dedicated and therefore not consistently available for long-term contracting or staffing of wildland response resources.

The significance of SB 96 is in the consistency it provides for acquiring long term aviation contracts, staffing wildland fire engines, supporting National Guard resources, and training and using Colorado Department of Corrections State Wildland Inmate Fire Teams. In wildland fire management, consistency in the availability of resources leads to increased efficiencies and effectiveness in response to wildland fires.

Having state wildfire resources identified, staffed, and positioned to respond will prevent some wildfires



Flames from the Big Fish Fire threatened historic cabins near Steamboat Springs in 2002, Colorado's worst fire season on record.

from becoming large catastrophic events and will assist in the containment and suppression of those wildfires that do escape initial attack.

Wildfires occur as unscheduled emergency events in wildland fuels (prairie or forest vegetation) and also in fuels that include a combination of wildland and human-introduced fuels (houses and improvements). Wildfires involve or threaten human life, residential housing and other improvements, and natural resources. Due to natural fuels buildup and increased population in wildland urban interface areas, wildfires that exceed the control efforts of local and county resources are becoming more common and more complex. Wildland firefighting in Colorado is interagency in nature involving state, county, local, federal, and tribal partners. Colorado State Forest Service is lead state agency for wildland fire as identified in the Colorado State Emergency Operations Plan.

Making Strides in Community Wildfire Protection Planning

After a challenging beginning in the development of Community Wildfire Protection Plans (CWPP) in Colorado, many groups and communities began to embrace the concept in 2006. The upsurge of completed plans, as well as those in progress, has risen dramatically. Planning processes have followed several models including subdivision "spark plugs" who initiated plan development; a Cooperative Extension director who facilitated the process; and a homeowners association that revised its Forest Stewardship Plan to include the necessary components of a CWPP. The plans also cover a wide geographic area and diverse demographic types.

All the plans follow Colorado's minimum standards, and CSFS foresters, local emergency managers, and representatives of local government were involved in all processes detailed below.

- Santa Fe Trail Ranch Estates near Trinidad completed its CWPP last year, due in large part to two residents, Dave Skogberg and Diana Novacek, who were unflagging in their promotion of FireWise practices and community wildfire protection planning.
- At the Woodmoor subdivision near Monument, community members took the opportunity to add elements of a CWPP as they revised their Forest Stewardship Plan.
- The Buckskin Heights CWPP process was driven by local residents, and meetings were facilitated by Emily Saeli, a graduate student in CSU's Department of Forest, Rangeland, and Watershed Stewardship.
- Three CWPPs have been completed in Jackson County due to the facilitation skills of Deb Alpe, a local Cooperative Extension director responsible for community capacity development.

Approaching the planning through a mixture of process models demonstrates that these plans can be developed at a variety of levels and through diverse courses of action. It also depicts the flexibility and adaptability necessary to address the needs of the community.

We congratulate the communities that have taken this critical step toward protecting lives and property from wildfire.



Resident Diana Novacek conducts a tour of the Santa Fe Trail Ranch Estates during the subdivision's community wildfire protection planning process.

Mauricio Canyon Fire

On Saturday, January 7, 2006, nature underscored the fact that wildland fires can occur year-round.

The last snow in south central Colorado had been in November 2005. Two pile burns, which had been conducted months earlier when snow covered the ground, flared up; normally, in January, snow would be piled two to three feet high. The fire spread rapidly in winds that exceeded 70 miles per hour. Homeowners in the Big Horn subdivision, near Aguilar in Las Animas County, had only one road out – directly in the face of the rapidly advancing fire.

Sunday night the weather had changed dramatically; it was snowing, but the fire also was still burning. By Wednesday, January 11, the snow had melted and the fire made a small run back to the west toward national forest lands. Finally, on January 16, control of the fire had been returned to Las Animas and Huerfano counties.

The Mauricio Canyon Fire started in Huerfano County and spread into Las Animas County, burning almost 4,000 acres and destroying five homes and 10 outbuildings. Costs for fire suppression exceeded \$500,000. The fire was an important lesson for Colorado: Wildland fires can occur at any time, especially during drought conditions.

Strategic Priority: Healthy, diverse, and sustainable forest conditions

Ensure healthy, diverse, and sustainable forest conditions on a meaningful scale throughout Colorado.

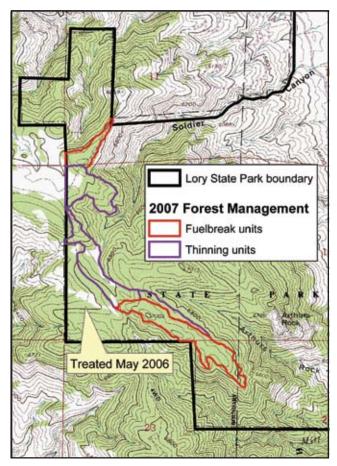
Front Range Fuels Treatment Partnerships Projects on the Golden District

The CSFS Golden District completed several successful projects within the Front Range Fuels Treatment Partnership (FRFTP) area during 2006. Several hundred acres were treated for fuels mitigation on Denver Mountain Parks, Colorado Division of Wildlife, Colorado State Land Board, Jefferson County School District, and private lands. These treatments reduced wildfire hazard, enhanced big game habitat, improved forest health, reduced insect/disease outbreak potential, and restored forest structure to more historical regimes. The projects were implemented via a combination of contracted services, seasonal field crews, local fire department personnel, and private landowners. Projects included:

- Reducing wildfire hazards and enhancing big game habitat on 198 acres of Mt. Evans State Wildlife Area in Clear Creek County near Evergreen.
- Reducing wildfire hazards and improving forest health on 140 acres at Windy Peak Outdoor Education Laboratory School near Bailey. In addition, the site provides an opportunity for school children to learn the value of forest health and fire mitigation.
- Completing more than 30 acres of fuels reduction and ponderosa pine restoration work at Cub Creek Park (a Denver Mountain Park) in a very visible area near downtown Evergreen. Many residents have commented on the positive, post-treatment aesthetics of the park.
- Working with a private landowner and using the Jefferson County fuels mitigation grant program to establish an eight-acre fuelbreak near Pine Junction.
- Providing insect and disease treatment on five acres of a degenerating lodgepole pine stand in Staunton State Park near Conifer.

Lory State Park Fuel Mitigation

In May 2006, a fuels reduction and dwarf mistletoe removal project was completed in Lory State Park. The project, implemented by the CSFS Fort Collins District, encompassed 67 acres. The location of the project within the park is strategic; the area is bordered on two sides by private property and is on the west side – the direction of the prevailing winds in the area. Fuel reduction in this unit not only will



Map of the treatment area in Lory State Park.



Some trees at Lory State Park were girdled. These trees, which eventually will die, will enhance wildlife habitat by serving as food sources and nesting sites.

decrease the chance of a fire spreading from the private land to the park's interior, but also will make it easier for a fire in the park to be contained before it spreads to private land.

Many of the ponderosa pines in this unit were heavily infested with dwarf mistletoe; however, infestation here was not as extensive as in other areas of the park, making control of the parasite relatively simple on this particular project. To control the dwarf mistletoe parasite, small clearcuts were created where dwarf mistletoe infested all of the trees. In stands where the mistletoe infestation was not as extensive or was nonexistent, individual trees or groups of trees were removed to reduce fuels.

For wildlife habitat enhancement, between two and five large-diameter infested trees per acre were girdled – a method that kills the tree but leaves it standing – to be used as food sources and nesting sites. Most of the previously dead standing trees also were left for use by wildlife.

CSFS Foresters Use Latest Technology to Inventory an Urban Forest

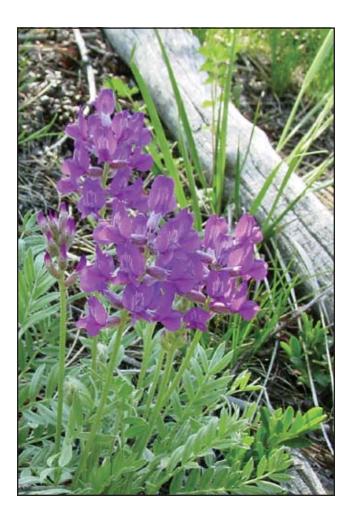
Most foresters are familiar with the use of Geographic Information Systems (GIS) and Global Positioning Systems (GPS) in traditional forestry applications such as mapping forest stands, treatment areas, property boundaries, roads, or other forest features. The use of this technology in recent years has greatly improved both the accuracy and ease with which CSFS accomplishes field work. Using GIS and GPS also can greatly facilitate the management of our urban forests. Recently, the CSFS Grand Junction District completed an inventory of the City of Aspen's publicly owned street and park trees.

As with any forest, proper management of the urban forest begins with a solid inventory of what is present and what the major management concerns are. Trees in the urban forest have special values as a component of landscaping and can greatly enhance property values. Street tree inventories are seen by city foresters as essential in order to schedule maintenance, to ensure proper forest diversity, and to manage potential liability issues from "hazard" trees. Having street tree information available in a GIS format also allows viewing of public tree information on city maps in relation to other infrastructure such as buildings, pipelines, utility lines, or street signs.

CSFS commonly assists communities with street tree inventories; three previous inventories completed for Aspen in the early and mid-1990s were done with hard-copy maps and paper forms, which were then transcribed into computer-aided drafting and database programs. The latest inventory used high-resolution aerial imagery provided by the city to pinpoint tree locations. Handheld devices were used to directly enter the inventory data digitally. The data then was imported directly into a GIS mapping program, effectively eliminating paper forms and data transcription.

Each tree within the city's right-of-way, or within a public park, was examined to determine species, size, condition, and pruning or other management needs. CSFS foresters collected data for more than 7,000 city-owned trees along 27 miles of right-of-way and in 35 parks. Potential planting locations were identified and coded for the appropriate-sized tree that should be planted. A major part of this inventory also included a special hazard assessment of more than 650 large trees in order to determine a defect rating.

The new street tree inventory has created a detailed and comprehensive data layer for the city of Aspen that is easy to understand, flexible, and compatible with their existing system; the inventory also can be easily updated. It will be a great tool for Aspen's city forester in the management of the community's forest for many years to come.





Mechanical fuel reduction often is accomplished by hydro-axe.

Montrose District Conducts Fuels Mitigation Project

The CSFS Montrose District is conducting a hazardous fuels mitigation project on private properties in Ouray County. Thinning and mastication – a mechanical fuel reduction technique that shreds brush and small-diameter trees – of select piñon pine, juniper, and gambel oak trees will be accomplished with a hydro-axe.

Implementation of this project, with cost-share and technical assistance provided the Montrose District, will safeguard against the spread of wildfire from Uncompandere National Forest to private property. Although the purpose of the thinning is to reduce the risk of catastrophic wildfire spread along these boundaries, there are added benefits to certain wildlife species through alteration of forest structure.

Seeding of critical project areas for wildlife habitat improvement will be done with the help of donations from Safari Club International and in conjunction with the Shavano Conservation District. Technical assistance for seeding will be provided by the Natural Resources Conservation Service (NRCS).

The CSFS and NRCS are assessing the interest level of local landowners to implement forest management practices to improve forest health, create defensible space, and improve wildlife habitat.



Swayback/Jenny Gulch Timber Sale

The Swayback/Jenny Gulch Timber Sale is Phase II of the Swayback/Jenny Gulch Good Neighbor Project. The project is a joint effort of the Colorado State Forest Service, Denver Water, Front Range Fuels Treatment Partnership, and USDA Forest Service. The work is being done on Denver Water and USDA Forest Service lands; the Colorado State Forest Service is managing the project through an agreement with the two organizations. The total project area is more than 400 acres; actual harvest activity currently is occurring on a portion of those acres.

The purpose of the project is to restore ponderosa pine forests to more closely resemble pre-settlement conditions, to improve forest health, and to reduce wildfire hazards. That means less dense tree stands, more open tree canopies, diverse age and species composition, and less Douglas fir.

The prescription for treatment in this area was developed by scientists and foresters who have studied the historical forest landscape at Cheesman Reservoir for more than 10 years to determine how presettlement conditions looked. Cheesman was studied because the occurrence of logging was limited during the presettlement period, and cattle grazing has not occurred for more than 100 years.





Restored ponderosa pine forest in the Trumbull-Swayback Demonstration Forest.

Openings were an integral part of ponderosa pine ecosystems during the presettlement era. Current research has concluded that openings distributed across the landscape in specific patterns can be a strategy to slow the spread of wildfire through tree crowns and aid suppression efforts. As part of the ongoing research of the Trumbull-Swayback Demonstration Forest, the partners are implementing concepts developed by the Fire Sciences Laboratory in Missoula, Montana, to determine the effectiveness and visual impacts of the placement of openings on the landscape, as well as test methodologies for creating them.

Strategic Priority: Education, communication, outreach, and policy

Address the growing public demand for information and promote informed decision making on natural resource issues by positioning CSFS as a recognized point-of-contact for Colorado on credible forestry and wildland fire information, expertise, and technical assistance.

Outstanding Forest Steward of the Year Teaches Kids of All Ages

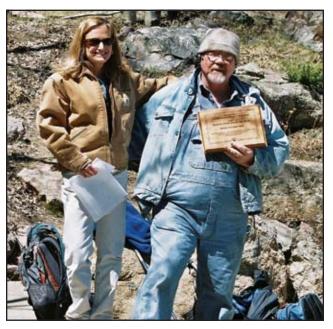
Bill Carpenter wanted to create a place where kids could come to play in the great outdoors, learn about the wonders of nature, express their creativity, and work with their hands. But when Carpenter refers to kids, age isn't a factor. He still believes that a little bit of the child lives in everyone, regardless of age.

As 70 students from Coal Creek Canyon K-8 School and parent volunteers, teachers, and the principal descended on the Carpenter Mountain Demonstration Forest for a tour of the interpretive trail on April 19, 2006, it was apparent that Carpenter is right.

With help from the Colorado State Forest Service, USDA Forest Service, American Forest Foundation, and others, Carpenter created the interpretive trail system in 2005. Since then, he has, upon request, opened the trail to fellow landowners and various groups and organizations for training and educational purposes. He also enthusiastically welcomes youth to visit – and experience – everything that nature has to offer.

Carpenter's experience on his own bit of forest began when he purchased 270 acres in 1984. From the start, he wanted to restore and maintain the health of his forested land, improve wildlife habitat and forage – and create the kind of views for which Colorado is famous. His vision has become a lifelong endeavor that earned him the 2005 Outstanding Forest Steward of the Year Award.

In a surprise ceremony at the Carpenter Mountain Demonstration Forest last April, the Colorado Forest Stewardship Coordinating Committee, along with the students from Coal Creek Canyon K-8 School,



Jan Hackett, CSFS Forest Stewardship Program coordinator, presents Bill Carpenter with the 2005 Outstanding Forest Steward award.

honored Carpenter for his active forest management and promotion of forest stewardship.

Colorado State Forester Jeff Jahnke selects the recipient each year based on recommendations by the Colorado Forest Stewardship Coordinating Committee.

"Mr. Carpenter embodies the spirit of the forest stewardship program," said Jahnke. "Not only does he actively manage his forest land to achieve health, vigor, and productivity, he also has opened his property to other landowners, school children, and the general public to help them understand why it's important to manage our forests." Surprised by the award, Carpenter thanked the committee but quickly turned to the students and asked if they had any ideas they'd like to share with him to improve the learning experience. One young student signaled to Carpenter that he had an idea or two he'd like to share and asked Carpenter to give him a call. Carpenter was delighted. To him, there's no greater measure of success than to know that he inspired a kid – no matter what age – to think creatively about what he or she had seen and experienced while on his property.

Project Learning Tree Celebrates 30 Years of Excellent Education

The Colorado State Forest Service celebrated 30 years of an award-winning, multidisciplinary environmental education program in 2006. Project Learning Tree (PLT) is a program for educators and students from pre-kindergarten through Grade 12 and is one of the most widely used environmental education programs in the United States and abroad.



PLT is CSFS' flagship program for reaching younger audiences via workshops for K-12 educators. Colorado natural resource educators helped create PLT in 1973, and the Colorado program has been coordinated by CSFS since 1984, training 500 to 800 educators annually.

PLT began in 1976 when natural resource managers and educators from the American Forest Institute (now the American Forest Foundation) and Western Regional Environmental Education Council (now the Council of Environmental Education) formed a partnership to develop an unbiased and scientifically and educationally sound program for elementary and secondary students and their teachers.

The partners designed PLT to be shared through trained facilitators (educators, resource managers, or other interested people) who, in turn, train others in how to most effectively and efficiently use the curriculum and materials. The first workshops were held in the 13 states that made up the Western Regional Environmental Education Council.

PLT continuously evaluates and updates its curriculum to ensure that it meets educator and student needs. The program meets state and national education standards in science, social studies, language arts, math, and other subjects – and strengthens students' critical thinking, team building, and problem-solving skills. Topics range from forests, wildlife, and water to community planning, waste management, and energy.

CAEE – Strategic Partnership for Environmental Education

Education is a conduit for fostering the public's knowledge, understanding, critical evaluation, and decision-making skills concerning Colorado's forests. Just as trees are part of a larger ecosystem, CSFS is a partner in a larger education effort – the Colorado Alliance for Environmental Education (CAEE).

A comprehensive network of schools, nonprofit groups, public agencies, universities, businesses, citizen groups, and volunteer organizations provide Colorado's environmental education. These programs take place in urban, suburban, rural, and wilderness settings and incorporate a wide range of educational approaches from informal experiential learning to formal classroom lessons reaching thousands of youth and adult learners each year. Ultimately, any and all of the specific forestry and resource conservation education efforts accomplished by CSFS exist within that overall learning context. Thus, the strategic partnership between CSFS and CAEE increases the capacity of both organizations to support all forms of environmental education and increase the effectiveness and quality of education available.

Strategic Priority: Critical agency relationships

Enable CSFS to foster and/or maintain credibility and thrive in a changing administrative and political environment through increased emphasis on building and maintaining relationships with the Governor's Office, Colorado State University, Colorado Department of Natural Resources and other key local, state, and federal partners and by meeting the needs of those partners through quality service.

Making the Connection on the Salida District

How do we recruit and then retain those professionals who buy forest products and timber sales? With rising fuel costs, will transportation costs keep us from selling as much wood and thereby limit the amount of work we can accomplish toward improving forest health?

Those questions were tackled by the CSFS Salida District and the Leadville and Salida Ranger Districts of the U.S. Forest Service, San Isabel National Forest, in the winter of 2005. With the mountain pine beetle carving out large swaths of lodgepole pine "on the other side of the hill," there was a good chance many loggers would be heading north. The goal was to keep them in the Arkansas Valley, so the Salida District and two USFS Ranger Districts teamed up to host a gathering of forest landowners, harvesters, and wood processors for a daylong event in February 2006.

"Making the Connection" was the theme, and the goal was to introduce landowners to harvesters and harvesters to wood processors through the day's events:

- Public and private landowners disclosed the type of wood and volume they needed to cut for the coming year, and wood processors shared what type of product they made and the type of wood they needed.
- Attendees learned about efforts in Leadville to use biomass for heating.
 - There was an introduction to lumber grading.
- The Colorado Timber Industry Association shared what was happening at the state level.

It was a solid beginning in the development of stronger working relationships among the many people who play a role in achieving healthier forests. The 2006 meeting was just a start; plans are underway for another gathering in 2007 entitled "Working Together."

Joint Fire Science Project Advisory Team

Community Wildfire Protection Plans (CWPPs) are an important means of reducing risk to communities and ecosystems of catastrophic wildfires. Enhancing collaboration and building community capacity are viewed as a means to ensure that these plans are responsive to the needs and objectives of communities located in the wildland-urban interface.

A Joint Fire Science applied research project called Enhancing Collaboration and Building Community Capacity is analyzing the lessons learned about collaborative processes among approximately ten CWPP development processes. These case studies are taking place in California, Colorado, Florida, Minnesota, and Oregon.

As part of the project, implementers from the five states were recruited to be a part of an advisory team to:

- Help the research team identify the relevant issues that are of greatest concern to local communities and managers who are developing and implementing CWPPs and monitoring results.
- Provide input in creating guidance material that will be used within the broader fire management community to address CWPP development and track their accomplishments.



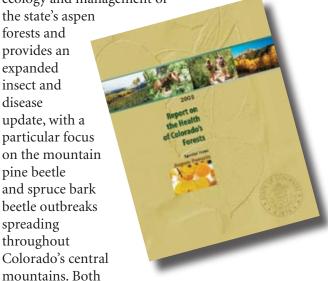
- Assist in building general awareness for this Joint Fire Science project through the members' organizations and their related networks.
- Recommend how best to increase the transfer of knowledge about the key results of the project through mechanisms like professional development, education and training workshops, and outreach.

Two CSFS foresters are taking part in this project as members of the advisory team to help the scientists move research to the point of implementation; to gain new knowledge in lessons learned and ways to move community wildfire protection planning forward; and to share experiences with implementers from the other four states.

2005 Forest Health Report

The 2005 Report on the Health of Colorado's Forests, released in February 2006, highlights the

ecology and management of the state's aspen forests and provides an expanded insect and disease update, with a particular focus on the mountain pine beetle and spruce bark beetle outbreaks spreading throughout Colorado's central



sections of the report underscore the need to address forest management in a proactive, rather than reactive, manner.

Many researchers and land managers attribute the size and intensity of bark beetle activity, at least partially, to the lack of age diversity in lodgepole pine and some spruce and ponderosa pine forests. This condition leaves forests extremely vulnerable to bark beetle attack.

In the absence of natural cycles of wildfire or other disturbance, forest management treatments can increase age diversity, decrease competition, and improve overall resilience among forest stands. But this action needs to occur prior to an insect epidemic in order to be most effective.

Bark Beetle Cooperative

Bark beetles are infesting and killing trees in Colorado's northern and central forests on an unprecedented scale. More than 700,000 acres were infested by the end of 2006. Concerns about the threats posed by dead forests – wildfire risk to communities and watersheds, loss of key wildlife habitats, and impacts to local economies and infrastructure – prompted the development of the Bark Beetle Cooperative.

The Bark Beetle Cooperative was developed in response to a meeting initiated by representatives of the Colorado State Forest Service and the USDA Forest Service (USFS). The event, conducted in October 2005, was organized to determine the locallevel interest in developing a coordinated response to the bark beetle outbreak. At that time, the area of concern comprised five counties in northern Colorado: Grand, Summit, Eagle, Jackson, and Routt.

The cooperative developed "A Strategy for Action and Assessment of the Bark Beetle Situation" in February 2006. This document identified values at risk, barriers to implementing a comprehensive bark beetle strategy, recent beetle activity, and assumptions for future beetle activity.

CSFS worked with local officials to identify priority areas for treatment. After the areas were mapped, CSFS, USFS, the Bureau of Land Management, and the Northwest Council of Governments met with the five counties individually to review priority areas. In late 2006, five additional counties expressed interest in participating in the cooperative: Lake, Park, Chaffee, Clear Creek, and Pitkin.

2007 promises to be an eventful year for this collaborative effort.

Strategic Priority: Foundations for effective program delivery

Maintain an effective foundation of administrative, planning, and development functions that provides the agency with the resources, direction, and support needed to remain focused on strategic priorities and to deliver the services and programs essential to Colorado.

FEMA Grant to Reduce Wildfire Risk

The Colorado State Forest Service recently was awarded a Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation Grant for Colorado Watershed Mitigation and Flood Risk Reduction. The \$3.3 million will fund wildfire risk reduction projects in seven state parks along the Front Range over the next three years. The \$2.5 million grant will be matched with \$800,000 of value provided by Colorado State Parks and CSFS to create fuel breaks, conduct forest thinning operations, and perform prescribed burns at seven Colorado state parks:

- Cheyenne Mountain State Park
- Eldorado Canyon State Park
- Golden Gate Canyon State Park
- Lory State Park
- Mueller State Park
- Roxborough State Park
- Staunton State Park

In awarding this highly competitive grant to CSFS, FEMA recognized the potential of severe flooding and debris flows following intense wildfire, in addition to the destruction caused by wildfire alone. Projects like this reduce the overall risks to the population and structures, while also reducing the reliance on funding from actual disaster declarations. Fuels mitigation plans in place for these parks and their strategic locations within Front Range watersheds were critical to their being included in this project.



Staunton State Park is one of the areas that will undergo wildfire risk reduction efforts through the Pre-Disaster Mitigation Grant.

"A grant of this nature that takes a proactive approach to protecting the watersheds, homes, and forests of the Front Range is unprecedented in the state of Colorado," said Colorado State Parks Director Lyle Laverty. "I applaud the hard work by Colorado State Forest Service staff, as well as FEMA's progressive vision."

Strategic Priority: Organizational environment

Cultivate and sustain an organizational environment that promotes the development and retention of core skills needed to achieve strategic priorities and delivery of programs; that recognizes and values employees' critical role in agency accomplishment; and that allows employees to meet their full potential in providing excellent public service.

CSFS 2006 Training Academy

In an effort to more efficiently expend the agency's training dollars and time spent by employees in professional development, CSFS held the first weeklong, agency-wide training academy in February 2006.

For five days, CSFS employees descended upon various training sites throughout Fort Collins. Subjects addressed included GIS point-of-contact introduction; contract administration; forest inventory techniques and best management practices; silvicultural lectures on various forest types by professors from the Department of Forest, Rangeland, and Watershed Stewardship in the Warner College of Natural Resources at CSU; collaboration and working with partners; beginning and advanced supervision; Excel, Word, Access, and PowerPoint proficiencies; and many more. Topics were determined by CSFS employee input and individual professional development plans. Sessions were further refined by supervisors, leadership staff, and adherence to our strategic priorities and agency needs.

In the end, 96 hours of training were offered and more than 70 employees attended, totalling 1,594 hours of training. Positive feedback and the academy's success led to the decision to make this an annual event.

Volunteer Program Continues Excellent Service

Volunteers continue to play an integral role in the Colorado State Forest Service and have served the agency in many capacities over the last several years. Volunteer projects in 2006 ranged from large, multiday projects coordinated through the Volunteer Forest Steward (VFS) program to small, one-time projects organized by CSFS district personnel.

The VFS program provided experiential learning, forestry-related training, and professional and personal development for volunteers in 2006. Volunteer projects encompassed more than 15 project-days – more than 2,000 volunteer hours. Each volunteer event included at least one learning component. For example, a project held in Black Forest, Colorado, in conjunction with the CSFS Woodland Park District, involved thinning young



Volunteers burn slash piles at Ben Delatour Scout Camp.



ponderosa pine stands and included an introduction to the Timber Stand Improvement model, wildland fire fuels reduction, habitat improvements, and chainsaw safety.

Increasing numbers of Colorado State University students are participating on CSFS volunteer events. CSU students accounted for more than 120 of the volunteer days implemented by the program in 2006. Student-related volunteer projects involve experiential learning in many aspects of forestry including tree planting, trail building, forest restoration, wildland fire, and firewood production. Volunteer events provide opportunities for students to understand the role of CSFS, learn and practice forestry-related skills, network with professionals in their chosen field, and build camaraderie with other students interested in service-learning. CSFS is continually developing strategies to engage CSU students; the volunteer program is a great tool to do just that.

The volunteer program generated more \$30,000 in in-kind grant-matching dollars in 2006. Though not actual money, this in-kind match helps improve forest conditions by helping grant recipients who receive federal dollars to implement forest improvement projects. For example, the VFS program held five workdays at the Ben Delatour Scout Camp in a project involving wildland fuels mitigation in the camp's ponderosa pine forest. The volunteer hours generated at the Boy Scout camp contributed more than \$6,875 in in-kind match for the camp's grant.

Additional program accomplishments included a software update for database management, newly forged partnerships with Larimer County Emergency Services and Colorado Outdoor Training Initiative, recruitment and retention of new volunteers, and successful volunteer event coordination with two CSFS districts that the VFS program has not served in recent years: La Junta and Alamosa.

Financial Statement

Expense

Salary, Wage & Benefits	\$7,337,113
Travel	\$378,547
Operating	\$11,989,819
Capital	\$366,500
Indirect / Utilities	\$2,190,786
Total Expense	\$22, <mark>262,766</mark>

Revenue	
State Cash Federal Total Revenue	\$(3,704,343) \$(5,702,228) \$(12,856,194) \$(22,262,766)
Fire Reimbursements # of Employees	\$(2,825,992) 126



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